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Table of Contents.

CLEVELAND HIGH PRESSURE FIRE SERVICE, ... FRONTISPIECE.

THE TOBACCO INDUSTRY, PART I, *Ira G. Hoagland,* 5

FIRE-PROOF BUILDINGS, ... 54
INSPECTION WHILE IN PROCESS OF CONSTRUCTION, *Henry V. Thayer.*

AUTOMOBILE GARAGES, *Alfred G. Patton,* 58

COMBINATION HEATING AND VENTILATING SYSTEMS, *F. M. Griswold,* 62

EDITORIALS, ... 66
LOCOMOTIVE SPARKS,
LARGE LOSS SPRINKLER FIRES,
HIGH PRESSURE FIRE SERVICE,
CLEVELAND HIGH PRESSURE SERVICE,
THE COTTON BALE AS A SOURCE OF LOSS BY FIRE.

PROGRESS REPORTS FROM COMMITTEES, ... 85
EXECUTIVE COMMITTEE,
SUBCOMMITTEE ON DENATURED ALCOHOL,
COMMITTEE ON FIRE-PROOF CONSTRUCTION.

TOBACCO FACTORIES—FIRE RECORD, ... 90

DEPARTMENT STORES—FIRE RECORD, ... 96

GENERAL FIRE RECORD, ... 110
FIRE-PROOF BUILDINGS FIRE RECORD,
UNSATISFACTORY SPRINKLER FIRES,
LARGE LOSS SPRINKLER FIRES,
SPECIAL SPRINKLER FIRES,
POINTS OF INTEREST, SPRINKLER REPORTS,
CAUSES OF FIRE,
SPECIAL HAZARD CAUSES,
COMMON CAUSES,
POINTS OF INTEREST, SPECIAL HAZARD REPORTS,
MISCELLANEOUS FIRE RECORD,
ELECTRICAL FIRES.

NOTES AND TABLES, ... 134
STEAMER "PLYMOUTH,"
DENATURED ALCOHOL IN HAT FACTORIES,
SOLVENTINE,
COLLAPSE OF REINFORCED CONCRETE,
DENATURING BONDED WAREHOUSE,
TEST OF DISCHARGE OF AUTOMATIC SPRINKLERS.

Reports on fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Cleveland High Pressure Fire Service.

Four 150 feet 3½ inch hose lengths from one hydrant, 2 inch nozzles, both Fire Boats operating. Pressure at nozzles 93 pounds, at hydrants 165 pounds, and at Fire Boats 235 pounds. The small stream on the left is a 2⅝ inch, 150 feet hose length, 1½ inch nozzle, from "Extra First" Fire Engine. These four streams delivered the highest solid column of water displayed, and could easily have been directed into eighth floor of Society of Savings Building opposite on the right, but not shown.

The Tobacco Industry.

INTRODUCTORY.

At first it was intended to confine the scope of this article to purely fire underwriting considerations as would be of interest to the insurance engineer and underwriter alike, but upon delving into the subject it soon became apparent that it would be at once of more interest and value to give a clearer exposition of the subject at length than would have been possible in an article of the limited scope referred to.

This paper is in the nature of a popular science monograph arranged so as to be of pertinent interest to the student of fire insurance economics and so constructed in several chapters that whatever is not desired need not be read.

The writer has endeavored to cover the subject as briefly as possible and begs to present to the readers of the Quarterly this monograph in which is outlined the following points: origin and development of tobacco; nature of leaf; statistical information showing importance of this country in industry at large; classification and description of various types of tobacco of commerce; methods of harvesting and curing tobacco; description of curing barns; preparing for and marketing tobacco; rehandling and stemming tobacco; manufacturing tobacco, cigars, cigarettes, granulated and fine-cut pipe smoking, plug and plug cut chewing, and snuff; tobacco warehouses; tobacco drying machines; special and common hazards; and miscellaneous considerations.

Origin and Development.

Tobacco has existed beyond the range of history. Civilization first learned of it through Columbus. On his voyage of discovery in 1492 he landed on an island in West Indies. Two sailors were sent into the interior to explore the country. They returned with tales of the natives inhaling smoke from, what appeared to them, firebrands. Investigation revealed that these were composed of leaves of a plant wrapped or rolled in husks of maize. The knowledge of the comforting and stimulating effects resulting from this indulgence were soon learned from the aborigines and in several hundred years this knowledge has spread over the habitable globe despite overwhelming opposition backed by legislative decree and social ostracism.

In 1559 tobacco was first introduced into Europe by Hernandez de Toledo, who took some from Santo Domingo to Spain. Jean Nicot, French Ambassador to Portugal, purchased some seed in Lisbon and introduced the plant into France that same year. A few years later a Prince of the Roman Church acquainted Italy with it. Historians differ as to whom it was that brought it into England. Undoubtedly it was by some one in charge of one of Sir Walter Raleigh's early exploration expeditions to Virginia. To Raleigh himself is ascribed the historical honor of making pipe smoking fashionable among the favored classes. This was in 1585.

Systematic cultivation of the weed was first undertaken in 1612 at the Jamestown colony in Virginia by John Rolfe, historically famed as the husband of Pocahontas. The colonists were encouraged to grow it and in five years every available piece of ground was being utilized, literally choking all the highways and by-ways of the colony. This was moderated by the governing authorities and new land was opened up and the cultivation extended. Thus was tobacco the foundation of the material wealth and prosperity of Virginia. Twenty thousand pounds were raised in 1619 and each year the crops increased until 1753 when 53,862,300 pounds were raised. All of this was exported. Later the cultivation was extended to Maryland. The Revolutionary War checked the exportation of leaf tobacco to an extent from which it has never recovered as foreign countries undertook its cultivation during that period and after the war did not cease it, so that while the world largely depends upon the American grown leaf, it does not wholly do so, as before 1772.

As early as 1785 tobacco was grown in Kentucky by settlers from Virginia and subsequently in Tennessee and Ohio. The leaf grown was, as is now termed, the dark export type and this continues to be the prevailing type raised in Kentucky, and Tennessee. Prior to 1833 practically all of the crops in these states were exported through the port of New Orleans, transportation thereto being had in river craft.

Inspection warehouses for tobacco were first established in Virginia in 1730 and during 1839 in Kentucky at Louisville and at Clarksville, Tennessee, in 1845. The object of tobacco inspection was to insure marketing of sound leaf and to prevent the exportation of inferior grades of tobacco.

Stemmeries were established by export tobacco buyers, as the tobacco trade developed, first at Clarksville, Tennessee, and later at Henderson, Kentucky. Although other markets have opened up these cities continue to be great "strip" markets for export tobacco.

Cultivation of tobacco in New England did not amount to much until about 1833 when it was discovered that a tobacco highly desirable for cigar wrappers could be grown. Not before 1828 did tobacco culture in Pennsylvania command interest, and in Ohio not until 1838 when some plants were grown from seed brought from Connecticut. Initial crops were grown in 1845 in New York State and in Wisconsin in 1850. In Florida cigar wrapper leaf was raised as early as 1829. Its culture was abandoned during the Civil War and was not revived before 1888. The present day industry in this state is based on the development of the Sumatra and Cuban types of wrapper and filler. Success in growing and curing the Yellow or Bright tobacco in North Carolina in 1852 made the development of tobacco culture possible in that and other states having considerable areas of soil with low fertility. Much of this variety is grown in southern Virginia and eastern Tennessee and further extension of its cultivation is both accomplished and assured.

The White Burley variety has given equally as great an impetus to tobacco culture in those portions of Kentucky and Ohio bordering on the Ohio River as the Yellow variety gave in North Carolina.

Definition.

The popular name of the weed "tobacco," is of Spanish origin and was derived from the name of the pipe, "Tabac," in which the leaf was smoked by the aborigines of the New World. The generic name "Nicotiana" after Nicot the French diplomat who introduced it into France, is assigned it by botanists in the order "Solanaceœ" to which order also belongs the deadly nightshade, or belladonna, the potato, tomato and other well-known vegetables. There are over seventy species grown in different parts of the world. The species "Nicotiana Tabacum" is the one most extensively grown and constitutes the bulk of the tobacco of commerce. American tobacco is most all of this species. The plant varies in growth from two to nine feet in height. The leaves are large and wide-spreading and are as much as two feet in length and in width average eighteen inches or so.

Tobacco is very susceptible to environment. Plants grown from seed of another section will assume the characteristics of the tobacco grown in that section. Climate determines flavor, and soil the color and texture of the leaf. The character of the leaf generally is altogether consequent upon proper cultivation. The texture of the Northern leaf is finer, larger and not as sweet as the Southern leaf which is smaller and quite thick.

Different processes of curing, fermenting and aging are required to develop color, flavor, aroma and proper condition of the leaf. Curing and fermentation involve certain chemical and physiological changes which will be briefly described later.

The alkaloid "nicotine" is the most characteristic of the constituency of the tobacco plant. Its content varies from 1 to 7 per cent. in the American leaf. Other constituents are organic and inorganic acids, albuminoids, cellulose, resinous fats, gum, oils, starch and sugar. The ash varies in proportion of from 12 to 25% of the leaf and consists of potash (fully two-thirds) lime and mineral salts. Proper burning of tobacco is influenced largely by an abundance of potassium salts and the content of cellulose. Albuminous and starchy matter, gum and some mineral salts hinder free burning.

Statistical.

The genesis of tobacco culture in America was in Virginia and up to 1870 that state led in quantity produced. After that time Kentucky forged ahead and in 1900 Virginia had to yield second place to North Carolina. In 1906, Ohio ranked second and North Carolina followed Virginia which still retained third place.

While all states and territories except five produce more or less tobacco only seventeen states in 1906 exceeded 1,000,000 lbs. each, of which thirteen produced more than 5,000,000 lbs. each, eight more than 20,000,000 lbs. each, four more than 50,000,000 lbs. each, and only one more than 100,000,000 lbs. In 1900 there were three states that produced more than 100,000,000 lbs. each.

These seventeen tobacco producing states of consequence are as follows, according to rank, crop of 1906: Kentucky, Ohio, Virginia,

North Carolina, Wisconsin, Pennsylvania, Tennessee, Connecticut, Maryland, Indiana, South Carolina, New York, Massachusetts, Florida, West Virginia, Georgia and Missouri. The first five are the greatest producers. Their combined crops in 1906 amounted to 76% of the national crop (682,428,530 lbs.). Kentucky's crop alone was 48% of this or 37% of the national crop and 11% of the world's crop.

In 1901 this country grew 36% of the world's crop and in 1906 only 29%, according to statistics published in the Year-Book of the Department of Agriculture. Since 1902 there has been a great decrease in production of domestic tobacco, and acreage planted and inversely an increase in yield per acre and price per pound. As compared with the crop of 1900 (814,345,341 lbs.) that of 1906 is 16% less in quantity but 27% more in value; average yield per acre 10% more and average farm price per pound 50% more.

Of the seventeen states producing the bulk of the 1906 crop, ten show a marked decrease as compared with the statistics of the Twelfth Census. This decrease is most considerable in the states of North Carolina, Virginia, Tennessee and Kentucky, the ratio of decrease being for each state 45%, 40%, 30% and 20% respectively. The unsettled conditions in the dark export tobacco region of Kentucky and Tennessee are well known and have been too well described in contemporaneous periodical literature to need more than passing mention in this paper. These troubles have caused curtailment of acreage planted in these states, yet the greatest decrease occurs in North Carolina and Virginia where there are not any such disturbances. The low price of tobacco which prevailed several years ago caused a number of growers to abandon its culture, with the result of the usual effect of demand on supply.

Tobacco exported during calendar year 1906 amounted to 336,730,455 lbs., over 2% less than the amount as of the Twelfth Census, but having a valuation of nearly 10% more. Importations of the leaf during 1906 amounted to 41,721,304 lbs., more than double those of 1900. Approximately 25% of quantity imported consists of Sumatra wrapper leaf and the balance unmanufactured leaf and cigars from Cuba.

Establishments engaged in handling and manufacturing tobacco in 1900 according to the Twelfth Census Report numbered 15,252, of which 14,539, over 95%, were engaged in manufacturing cigars and cigarettes; 437, less than 3%, in manufacturing chewing and smoking tobacco and snuff; and 276, less than 2%, in handling and stemming tobacco. The total value of the combined products of all was $283,076,546, of which 56% was in cigars and cigarettes, 37% in chewing and smoking tobacco and snuff and 7% in tobacco stemmed and rehandled. The amount used was 379,162,884 lbs., of which 28% was for cigars, 3% for cigarettes, and 69% for smoking, chewing tobacco and snuff. This has steadily increased each year and in 1905 the total amount used was over 20% more than that of 1900.

In the manufacture of cigars Pennsylvania ranks first in quantity made, followed by New York, Ohio, Maryland and Illinois. The combined output of these states in 1900 was nearly 70% of the entire production. Practically all of the cigarettes are made in New York, Virginia, North Carolina, Louisiana and California. Of the 437 estab-

lishments engaged in the manufacture of chewing and smoking tobacco and snuff as recorded in 1900, 17% were in North Carolina, but in output Missouri led followed by Kentucky, North Carolina, Virginia, New Jersey, Maryland and Ohio and other states having less than $5,000,000 output value. Stemming and Rehandling Establishments were distributed as follows; 36% in Kentucky, 19% in Virginia, 17% in Ohio, 10% in Pennsylvania, 8% in Tennessee, 3% in New York, 2% in North Carolina, and 1% in Connecticut; the balance scattered. Fully 90% of the values were handled in Virginia, Kentucky, Ohio and New York in order named.

Most of the data in this statistical narrative was obtained from the Report on Selected Industries Twelfth Census, that of 1900. Since then many changes of an economic nature have occurred which modify the facts indicated by these statistics. A comparison between the future Thirteenth Census and the Twelfth will be most interesting as regards the tobacco industry, probably more so than at any other period, such will have been the extreme changes of the decade.

Classification.

"The principal kinds of tobacco grown in this country are the *Cigar* types for our domestic supply of cigars; the *Manufacturing* types for smoking and chewing; the *Bright Yellow Tobacco* for cigarette smoking and plug wrappers; *White Burley* for smoking and chewing, both for domestic and export trade; and the *Export* types proper, which are not suited to our domestic use, but which are mainly exported to foreign countries to be used both for cigar and manufacturing purposes." (From "Tobacco Soils" Farmers' Bulletin No. 83, Department of Agriculture.)

"At the beginning of the present century the dark export types of Virginia and the light pipe-smoking tobacco of Maryland were the only classes of tobacco grown in this country. It has been within the present century that the cigar, the lemon-yellow cigarette, the mahogany manufacturing, the Burley and Perique types of tobacco have been developed." (From "Growth of The Tobacco Industry" by Whitney and Floyd, Reprint from Year-Book of Department of Agriculture for 1899.)

Tobacco is classified according to purpose of use (class); general qualities of the leaf (type); and degree of excellence of the leaf (grade). To illustrate; cigar leaf (class); Sumatra wrapper leaf (type); dark good leaf (grade).

Cigar Tobacco.

Three distinct types of tobacco are necessary for the complete cigar. What would do for a filler would not answer for a binder leaf and the wrapper leaf has to possess many points of excellence. Theoretically, one plant would be supposed to produce all types of cigar leaf necessary, but it is seldom possible to do it as the requisite characteristics of each type depend upon nature of soil in which it is grown. Leaves of the finest quality and texture are used for

wrappers; those of inferior quality for binders; and the dark, strong, heavy leaves for fillers.

Wrapper tobacco is grown chiefly in the Connecticut River valley and in Florida; also to a less extent in New York State, Pennsylvania and Wisconsin.

Binder grades are grown, more or less, in all of the wrapper producing states, but especially grown in Wisconsin.

Filler leaves are especially grown in Pennsylvania, Ohio and Florida.

Three varieties of wrapper leaf are now grown in the Connecticut Valley. For a number of years the Broad and Havana Seed Leaf were the only types, but recently through the efforts of the Department of Agriculture the Sumatra Leaf from Florida grown seed has been introduced.

In Florida two types of tobacco are grown, a wrapper leaf from imported Sumatra seed and a filler leaf from seed imported from Cuba. The Sumatra leaf is grown in the so-called old area in the northwestern part of the state. The Cuban leaf is also grown in this area but altogether in the new area opened up on the peninsula.

All cigar tobaccos are air-cured. Subsequent fermentation is accomplished in two general ways. The method in vogue in Northern districts is the "case-sweat" or allowing fermentation to take place while the leaf is packed in cases. The Florida and Connecticut grown Sumatran leaf is fermented in "bulk," i. e. piling the tobacco in heaps to ferment or "sweat." This method of sweating in bulk is fast gaining favor throughout the cigar leaf districts.

Manufacturing Tobacco.

The so-called manufacturing types are often confounded with the export types as both varieties are often grown in the same section and used for both purposes.

In general they are the mahogany, red, brown and other colored, types of Virginia, Maryland, Ohio, the Carolinas, Tennessee, Kentucky and Missouri.

The light colored tobacco of Maryland is air-cured and similar types in Ohio are cured by wood fires. Mahogany types are flue-cured generally, and others by these methods and also by the sun.

This class of tobacco is used generally for fine-cut pipe smoking and chewing and cigarettes and for plug and twist wrappers and fillers.

Yellow or Bright Tobacco.

This variety is grown mainly in the Piedmont region of southern Virginia and the Carolinas and also in eastern Tennessee. It is being introduced into other states and further extension of its cultivation is probable. Sandy sterile soils are well adapted for its cultivation.

In 1852 in Caswell County, North Carolina, it was demonstated by the Slade Brothers that tobacco could be grown in the sterile sandy soils of that section and that by curing the leaf with carefully regulated fires a lemon-yellow color could be obtained.

The culture of this type of tobacco has been the foundation of the prosperity of North Carolina and heretofore worthless lands have become of considerable value because of it.

Yellow tobacco is mild and sweet flavored. It is used for wrappers and fillers for plug tobacco, for cigarette fine-cut, and the lower grades—lugs and cutters—for granulated pipe-smoking tobacco.

All of this type of tobacco is flue-cured.

White Burley Tobacco.

Cultivation of this variety is confined to the so-called "blue grass" region of Kentucky and Ohio.

The type is a "sport" originating from several white plants found in a Red Burley seed-bed on an Ohio plantation in 1864. It has a mild flavor, low content of nicotine and great absorbing capacity for flavoring sauces, which make it especially valuable for the domestic sweet chewing plug. The lighter grades containing but little oil and gum are used for fine-cut smoking, and the lower grades—flyings and trash—sometimes for granulated smoking.

Practically, all of this tobacco is used in this country. A little is exported and it is growing in favor abroad.

Curing is by air except in cold, damp weather when heat from open wood fires, stoves or lamps is used to prevent excessive moisture in the air in barn.

Export Tobacco.

Types of this class, variously termed dark export, heavy shipping, etc., are grown in heavy fertile soils chiefly in western Kentucky and Tennessee, to a less extent in Virginia, and North Carolina and some in South Carolina, Illinois, Indiana, West Virginia, Missouri and Arkansas. The light tobaccos of Maryland and Ohio are also largely exported and to a minor extent are the Bright Yellow and White Burley varieties. Many of the better grades of export leaf proper are being used for domestic manufacturing purposes nowadays as they command a better price at home than abroad.

Generally the leaf is large, fat, tough and elastic and has a large content of nicotine and creosote, which is especially desired abroad. The curing is done altogether by slow-burning hardwood open fires, the smoke having a preservative effect on the leaf and giving it a smoky flavor.

Of all the tobacco exported, Great Britain takes the most, pays the highest price and gets the best quality. Each country varies in its requirements as to quality desired and the so-called "Regie" countries, where the government monopolizes the handling of tobacco, take the inferior grades.

Perique Tobacco.

The cultivation of this variety is so limited that it is of practically no importance in the market and as market grown tobaccos are only considered in this paper the writer will refer the reader to that very excellent work "Tobacco Leaf," by Killebrew and Myrick, published by Orange Judd & Co., New York.

Harvesting Tobacco.

Though tobacco is a perennial plant it has to be grown each year from seed. The seed is planted in a specially prepared seed-bed and when the plants have attained sufficient growth they are transplanted in the field.

There are several methods of harvesting. The oldest and most general method is to cut the whole plant when there is an average condition of ripeness. This prevails in the Northern cigar leaf, manufacturing and export districts. A later and more desirable method is to "prime" (cut or strip) the leaves from the stalk as they ripen.

The period of harvesting varies with section where the tobacco grows. In Florida "priming" the Sumatran leaf begins in the middle of June and continues until the middle of September. The Cuban leaf is harvested both by cutting the whole plant and by cutting the stalk in sections. The "priming" method is also used. If the plants are cut they are speared on poles or laths and hung in the curing barns. If "primed," the leaves are gathered up in baskets and strung on poles in the barn to cure.

Harvesting Bright Yellow tobacco begins the latter part of July in South Carolina and later in the northern part of the district. The "priming" method has to a large extent displaced that of cutting the plant. The leaves as "primed" are hung in the curing barn.

White Burley tobacco begins to be harvested about the middle of August. The stalks are first split down, then cut, the plants laid awhile on the ground to wilt, then straddled over sticks supported on a scaffold in the field. In this way the plants are allowed to stay for a week or so to thoroughly wilt before being hung in the curing barn.

Export tobacco is ready for harvesting early in September. It is harvested quite similar to White Burley.

Curing.

The object of curing tobacco is not more to dry out excess water in the leaf than it is to obtain the desired color, fix it and arrest escape of juices. This is also termed "killing the leaf." Curing processes vary with kind of leaf and use for which it is intended.

To properly develop flavor and aroma in the leaf, tobacco undergoes a period of fermentation after curing which will be discussed later on.

Generally speaking there are two ways of curing tobacco, one natural, the other artificial. Natural methods make use of the air or sun, and artificial methods heat from open or closed fires.

Use of artificial heat began early in the Nineteenth Century as is outlined in the following excerpt from "Growth of The Tobacco Industry, by Whitney and Floyd, Reprint from Year-Book 1899, Department of Agriculture": "In 1812 the demand by foreign countries for colored tobaccos was so great that artificial heat was employed in curing. In this way the piebald or spangled tobacco of Virginia was developed. Until 1828 wood fires were the only artificial means known of curing tobacco. About this time flues and charcoal fires began to

be used. It was not until 1865 that flue-curing entirely superseded charcoal fires in the production of the bright yellow varieties. * * * ."

Tobacco to be sun-cured is left in the field on scaffolds after harvesting and is only covered during a storm. Air-curing is accomplished under cover in tight barns, especially designed for the purpose nowadays. Numerous ventilators are provided in these barns which are opened on favorable days to aid the curing.

Cigar tobaccos are air-cured almost exclusively, except in Ohio and Wisconsin where small stoves or lighted lamps are often used to dry the air in the curing barns on excessively humid days in wet weather. In curing the Connecticut Valley Sumatra leaf it is often necessary to do likewise. Small open fires of wood and charcoal are used. White Burley is air-cured and in rare cases wood or charcoal fires are built in damp weather. Some manufacturing and export tobaccos are cured by air.

There are two methods of using artificial heat for curing, by building open fires of hardwood or charcoal on the barn floor and by radiation of heat from flues heated by furnace fires. Most Export tobacco is cured by open wood fires and Bright Yellow is flue-cured exclusively. These are the most notable examples of the application of the two methods.

Curing of Export tobacco takes about five days. Fires are built small at first and the temperature started at 90° F. This is gradually raised by building larger fires until a maximum of 150° F. is reached. Well-seasoned hardwood is generally used to insure a minimum of smoke.

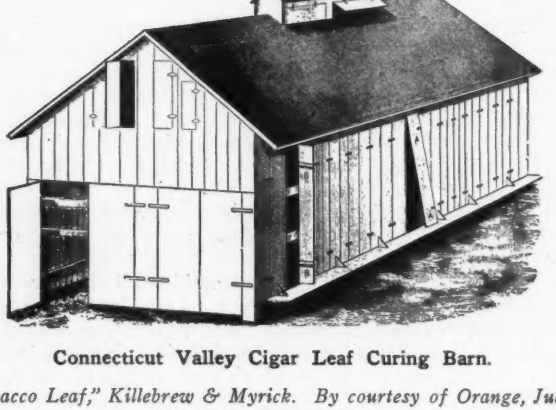
In the Bright tobacco districts the "primed" leaves are hung in the barns immediately after harvesting. The barns, purposely small, are quickly filled and the firing begun. Temperature is started at 90° F. and gradually raised to 180°, the maximum. In about four days the cure is complete.

Air-curing of Cigar Leaf takes several months, and of White Burley about six weeks.

Tobacco Curing Barns.

Curing barns are variously modified in construction and arrangement to fit the methods in vogue in the various tobacco growing sections. Thirty years ago most any sort of building would answer for curing purposes. Today barns are especially constructed for the purpose.

Wood is almost universally the building material. Two general types of barn are in use, the framed barn and the log barn. The former is built of a wooden frame sheathed with wood, generally one story high with a gable roof. Sometimes barns have basements and otherwise are often elaborately finished according to the taste and wealth of the planter. Inside the barn is arranged a stout framework of timbers which supports the poles or sticks of tobacco. These barns are often very large and are generally rectangular in shape. Schemes for ventilation are numerous, some quite elaborate and involving application of mechanical devices. The prevailing method is to hinge a number of sections of the sides of the barn and open or



Connecticut Valley Cigar Leaf Curing Barn.

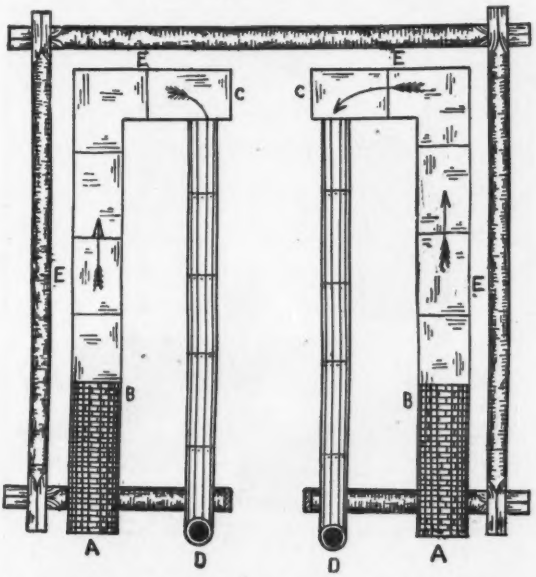
From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

Five Room Six Tier Flue-Curing Barn used in Bright Yellow Tobacco Districts.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

close these hinged sections by hand. These barns are usual in the Connecticut Valley, Eastern Pennsylvania and the Central States.

Framed barns in the Export tobacco districts are tightly built without ventilating openings, these barns being heated by open fires. The shape is generally square ranging in dimensions from 26 to 48 feet square. A barn 40 feet square will hold about six acres of tobacco. Many of the barns are so built that the lowest tier pole upon which the sticks of tobacco are hung is three feet or so above ground. Holes for the fires are then dug in the floors, some seven or eight feet deep. This arrangement is accounted to be much better and safer than where the fires are built on a flat floor subject to disturbing influences of



Ground Plan of Flue-Curing Barn used in Bright Yellow Tobacco Districts.

Showing arrangement of furnaces and flues. AA, furnace entrance; BB, furnaces; EE, direct flues; CC, return flues; DD, vents.

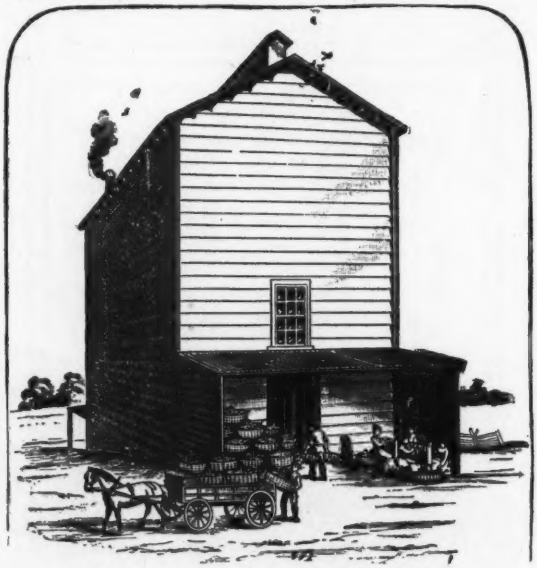
From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

draughts, and also the fires can be better regulated. In barns with flat floors the lowest tier poles are about eight feet above grade. The fires are built between two logs, arranged parallel with one another a short distance apart. Fires have to be carefully attended for if they blaze up there is great danger of setting the tobacco afire.

Log barns are essentially the pioneer type. The old style southern barn was merely a shelter built of logs, with the interstices left open and covered with a hipped roof, ends left open. Early flue

barns were built of round logs and the cracks between them daubed with mud. Later it was found that hewn logs were better adapted. Sometimes mud or clay walls are built by tamping such material in wood forms and burning the forms away after the walls are finished so as to harden them. Sizes have varied from 20 to 24 feet square and additional capacity as needed has been obtained by adding "lean-to" sheds, 12 to 15 feet in width, on all sides of the barn.

Inasmuch as there are many modifications of this type of barn, arrangement of flues, etc., some of which are patented, it will suffice in this paper to describe an ordinary and a patented barn as used in the Bright tobacco section.

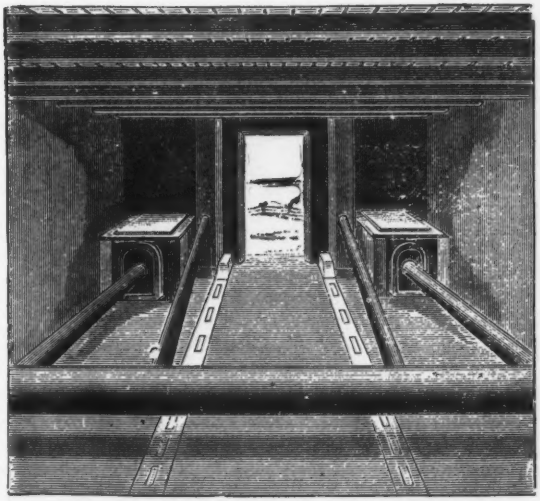


Exterior View Snow Tobacco Curing Barn.

Shows entrance to floor above furnaces which are on opposite side. Wagon in foreground is laden with "primed" leaves from field and under shed the leaves are being strung on poles for curing.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

Ordinary barns for flue-curing Yellow tobacco are built in most cases of hewn logs with interstices pointed up with lime mortar or mud. An average size for such a barn is 17 feet square and 17 feet high with hipped roof. For supporting the sticks or poles of tobacco such a barn would have four sets or "rooms" of tier poles, four high. A set of tier poles is made up of horizontal poles the lowest eight or nine feet above grade, which carry the sticks of tobacco; these poles are spaced about four feet and supported by vertical poles spaced about



Basement Snow Tobacco Curing Barn.

Showing furnaces, arrangement of heating flues and chimneys and slatted floor above.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

three feet. The sticks hold about eight plants each, and spaced eight inches apart the horizontal tier poles would hold about 25 sticks each "room" and the capacity of the whole barn would be about 400 sticks or 3,200 plants, the product of over an acre of tobacco.

Several dozen of such barns are on a single plantation. The limited size is necessary to insure proper curing and as the barns often burn up the fire loss is minimized also.

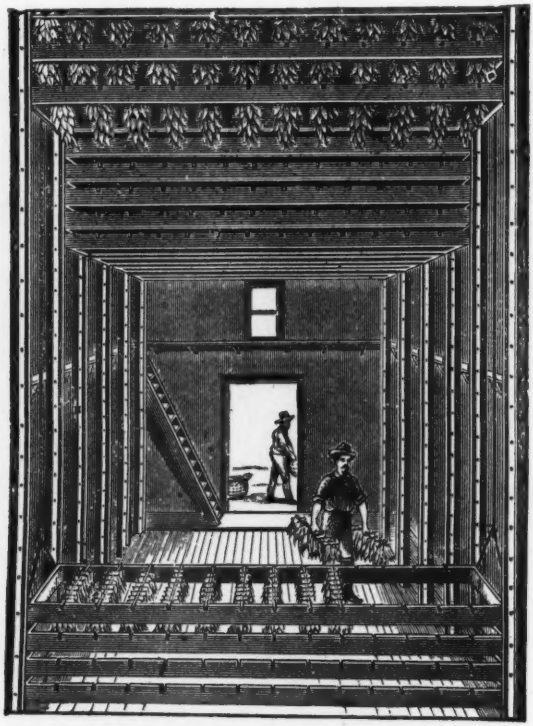
The heating equipment of these barns consists of two furnaces of brick arch construction—perhaps—built in one end of the barn on the ground about 20 inches from and parallel with the side wall. The furnace walls project out beyond the line of the end wall of the barn over a foot. Each furnace is about 18 inches wide, 20 inches high and over four feet long. The flues from the furnaces extend to the rear end of the barn, change direction and return to front wall through which they vent outside. The flues are slightly inclined upward to promote draught.

In older barns the direct flues from furnaces are of brick or mud sides, or trenches dug in the floor, with top covered with sheet metal. The return flues of sheet metal pipe are about 12 inches in diameter.

Flues in modern barns are all of metal from furnace to vent and if a brick chimney is not used the flues are often joined together and vented outside through one smoke pipe.

A typical patented flue barn is the Snow Barn. Many advantages

of a technical nature are claimed for this barn, also that less fuel is required than the ordinary barn and that there is less hazard from fire. This type of barn is used in curing leaf harvested by "priming." An average size is 16x20. Construction, timber frame, wood sheathed outside, and also inside for better insulation against escape of heat; roof hipped and covered with shingles. Height, two stories; first story for furnace and flues, and second for hanging leaf to be cured. The furnaces and flues are arranged similarly to those in ordinary flue barns. The furnace or stove itself is different being of metal set under arches of brick which extend out beyond and over. A slatted



Upper Part Snow Curing Barn.

Showing method of hanging leaf for curing.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

floor is built about seven feet above furnace floor. Above this are tiers of rectangular frames arranged to work up and down in grooves. These frames or racks carry the sticks of tobacco to be cured.

A system of flue heating to control the wet weather atmospheric conditions of the Wisconsin and Ohio Cigar leaf regions has been suggested to take the place of lamps and stoves. The barns in these sections are often very large and it would be necessary to install a large number of furnaces. Such an arrangement would be temporary, the idea being to remove the stoves and flues after the completion of curing.

A "Hand" of Maryland Tobacco.

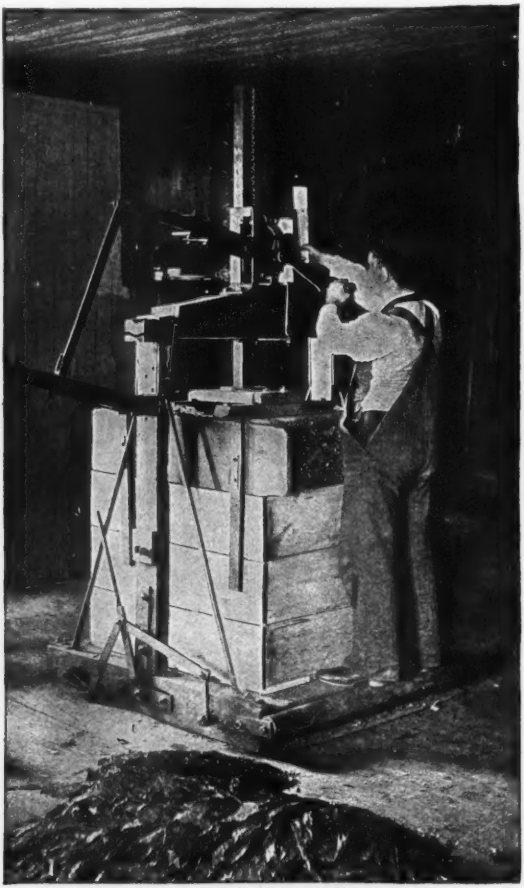
By courtesy of the United States Department of Agriculture, from pamphlet "Growth of The Tobacco Industry," by Whitney and Floyd, of Division of Soils. Reprint from year-book of Department for 1899.

Preparing Tobacco for Market.

The handling of tobacco after curing varies widely in the different growing sections.

In most of the Cigar leaf districts of the North the method is about as follows: The first damp day after curing is complete the tobacco is taken down, "struck" down as it is termed. This moist condition of the atmosphere insures the leaf being in proper "case" or "order" which means that the leaf is moist enough to handle

without breaking. Tobacco absorbs moisture easily and when moist is tough and elastic but when dry it is very brittle and readily breaks to pieces. After "striking" down, the sticks of tobacco are piled in heaps and covered with cloths to keep the "order" until time for stripping. Some growers strip the leaves from the stalk and put them up in paper bundles without assorting and sell to dealers. More progressive planters do their own sorting and grading.



"Prizing" Cigar Leaf into Cases.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

The leaf is assorted and graded according to the character, size and color of the leaf into long and short, bright and dark wrappers, binders and fillers. The leaves are made up into bundles or "hands," tied together at the butts, and packed into cases. The packing or "casing" as it is termed, is done in wooden cases about 28 inches square in the ends and 36 inches long, each holding 300—350 lbs. of tobacco. The cases are not tight, the sides having air spaces left in them to permit of sweating the tobacco in cases.

The next operation is "sweating." "Sweating" or fermentation is necessary to condition the leaf and develop its flavor and aroma. It is generally done by the dealer or manufacturer. The leaf is "cased" in the fall and the cases piled in a close warehouse. The temperature is uniformly maintained during cold weather and until after the next summer. When the sweating is completed the cases are opened and the tobacco is sampled and sold at private sale. This is a year after harvesting.

The Sumatran wrapper leaf grown in the Connecticut Valley is handled very different from foregoing. The method described as regards sweating is known as the "case sweat." Sumatran leaf is fermented by the "bulk" method, sometimes termed "bulk sweat," much the same as it is done in Florida.

When "struck" down in the curing barn the leaves are tied into bundles by means of the stick strings upon which they were strung to cure. These bundles are piled in bulks of 3,000—6,000 lbs. each, to ferment. The bulks are made about seven feet high and rest on platforms five feet wide and twelve feet long, raised several inches above ground. The temperature of the room is maintained at 70—80° F. by steam or other heat and the air is humidified by rapid evaporation of water or by steam spray. The action of fermentation within the bulk generates heat and in a week or so the temperature rises to 130° F. or thereabouts. Above 130° it must not be allowed to go so the bulks are pulled down and rebuilt, each bundle being thoroughly shaken as the change is made. This tearing down and rebuilding is repeated several times before fermentation is complete. After this the tobacco is assorted, tied into "hands" and packed into bales quite the same as the imported leaf. These bales are 30 inches square and 12 inches thick and weigh about 150 lbs. They are covered with matting and burlap.

In Florida there are two distinct varieties of Cigar leaf, namely, Sumatra wrappers and Cuban fillers. The methods of handling, however, are quite similar. After curing the leaves are stripped from the stalk or section of stalk according to manner of harvesting, tied into bundles and taken to the Fermentation Houses.

Details of handling the different varieties vary a little according to the nature and condition of the tobacco. As received from growers' barns, the leaf is roughly graded into wrapper and filler leaf to be separately fermented. If in proper order, with 24% of moisture, the bundles of leaf are "bulked." If not in good "order" the "hands" are shaken out and sprayed with water or "ordered" by being turned over in piles in an "ordering" room humidified with steam sprays.

The "bulks" are built quite the same as described in connection with the Connecticut Valley Sumatran leaf. During fermentation

considerable heat is generated and the temperature is carefully watched to see that it does not rise too rapidly nor too high, for if it did the leaf would be spoiled. As the temperature rises to the limit set, the "bulk" is pulled down and rebuilt. Ordinarily the temperature rises at the rate of about 10° F. a day and authorities state that a proper maximum is 135° F. The temperature does not rise as high nor as fast in consequent "rebulkings" as in former ones and in the last period, termed the "cold sweat," fermentation ceases. Seldom the temperature is allowed to go above 145° F. although 180° F. has been reached it is claimed.

It is quite apropos at this point to briefly discuss the theory of fermentation of tobacco. By proper fermentation only is it possible to develop the flavor and aroma in any tobacco and proper fermentation is only possible when the leaf is properly cured.

As a result of investigation made in co-operation with the Division of Soils, Dr. Oscar Loew formerly of the Division of Vegetable Physiology and Pathology, United States Department of Agriculture, opposes the claim of Suchsland that the flavor and aroma of Cigar leaf tobacco is due to the action of bacteria. Dr. Loew's investigations reveal that fermentation in the leaf is in the nature of oxidation brought about by soluble ferments similar to diatase, the active agent in malt fermentation. The action of these ferments, or enzyms as they are termed, is analogous to that of a rusty nail on the wood in which it is embedded. The wood oxidizes more rapidly about the nail than elsewhere being able to take up oxygen more freely in presence of the iron oxide in the rust on the nail. Therefore these oxidizing enzyms merely act as oxygen carriers to the substances of the leaf and in doing their work generate heat. When sufficient oxygen has been carried and fermentation is complete, these enzyms, having served their purpose, disappear.

It is not desirable that the heat be allowed to get too high in the wrapper. With the filler leaf it is different for the farther the fermentation goes the better will be the leaf for filler purposes. To this end it is "ordered" or "petuned" after complete fermentation and rebulked to again ferment. "Petuning" is a Cuban process and consists in spraying with or dipping the leaf in a liquid made up of a decoction of tobacco stems, molasses, rum, sour wine, etc.

After fermentation the tobacco is carefully sorted and graded. The Cuban tobacco is made up into cylindrical bundles called "carottes" and baled same as in Cuba. Sumatra leaf is baled as described in connection with the Connecticut Valley variety. Before this tobacco is used it is kept in warehouses for two or three years to age and mellow.

In the Bright Yellow sections after curing, the barns are opened and fires extinguished. Sometimes to "order" the leaf for "striking," wet straw is laid on the hot flues. As the tobacco is "struck" down the loaded sticks are "cooped" or "shingled" in piles. This keeps "order" for stripping. After stripping the leaves are sorted and roughly graded, tied into "hands" and "bulked down" for a couple of months to improve the leaf and fix color. Sometimes the "hands" are hung up in the barn close together instead of "bulking." The tobacco is now ready for market.

White Burley tobacco after curing is "struck" down, sticks "shingled" in "bulk," then stripped, assorted and roughly graded, tied into "hands," rebulked for awhile then "prized" (packed) into hogsheads. This is known as "winter prizing." Some of the tobacco is

"Breaking," Inspecting and Sampling Tobacco before an "Inspected Leaf" Sale or "Break" in Export Tobacco District.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

allowed to remain in bulk until the following summer. As fermentation takes place in the leaf in "bulk"—never much if any if bulked in proper "order"—it is carefully watched and if the temperature rises too high the bulk is pulled down and rebuilt. In June the tobacco is hung in the barn to "sweat." Some growers "shingle" sticks of tobacco until May then hang up for "June Sweat." After this the leaf,

when in good order, is "struck" down, stripped, graded, bundled and "prized." This is known as "summer prizing."

Export tobacco is treated quite the same as White Burley except that fermentation in "bulk" after stripping and grading is considered of more importance in improving leaf.

MARKETING TOBACCO.

Only in the Bright Yellow, White Burley and Dark Export tobacco districts is there organized system in marketing tobacco. In these sections the tobacco growing centers have storage and sales warehouses for convenient handling of the leaf during marketing season.

There are three methods of marketing tobacco, viz: by private sale at farmer's barn or dealer's warehouse; selling leaf "loose" (in heaps) at public auction, the sales being termed "breaks"; and selling "inspected" leaf in hogsheads from drawn samples at public auction.

Cigar leaf is generally purchased from the growers in field or barns by the dealers or manufacturers' agents who, by handling large quantities, can secure more uniform results in conditioning and grading. The case packed leaf of the north is generally sold at private sale. In Florida the planters sell their crops, to a large extent, direct from curing barns to dealers who maintain large central fermentation houses. The growers themselves sometimes co-operate and maintain centrally located fermentation houses. This is much more economical and successful than when individual growers attempt to do their own fermentation, sorting and grading.

The "loose" method of marketing prevails in the Bright tobacco district of Virginia and North Carolina. Sales warehouses are centrally located in the various growing sections. They are of large area, and well lighted. Tobacco to be sold is brought in by farmers in wagons and those growers remotely located ship their crops in tierces containing from 250 to 600 lbs. A tierce is a cask shaped like the frustrum of a truncated cone, measuring about three feet in smallest diameter and about four feet high. The leaf as received is loaded on the warehouse trucks, weighed and dumped in neat piles on the floor. Each pile is marked by a card having certain descriptive information on it and the tobacco is then ready for auction. In the Danville, Virginia, market, accounted to be greatest leaf market in the country, the tobacco to be sold is classified as "wrappers," "fillers," (both for plug manufacture), "cutters" (for fine-cut) and "granulators" (for granulated pipe smoking). After the sale the buyers' helpers gather the purchased leaf in large baskets and carry it to the buyers' prizery or stemmery.

The "inspected leaf" system of public sales is general in the Dark Export tobacco sections. Warehouses in which the sampling and selling are done are licensed and governed by law. Warehousemen are supposedly compelled under the law to keep their warehouses clean and in good repair and the hogsheads of tobacco skidded above the floor. As a hogshead of tobacco is entered in the warehouse to be sold the top head is removed, the hogshead inverted and lifted from its contents. Under supervision of a sworn and bonded inspector the

cylinder of tobacco thus exposed is broken in several different places by means of a lever and several sample "hands" are withdrawn from each "break" and bundled together; then labeled, sealed and tagged, and laid on top of pile awaiting time of sale. This method eliminates fraud in packing and insures a good understanding of the nature of the

Interior of a White Burley Tobacco Curing Barn.

Showing leaf rehung after stripping from stalk.

From "Tobacco Leaf," Killebrew & Myrick. By courtesy of Orange, Judd & Co., Publishers, New York City.

leaf offered for sale. After the auction the cask is replaced over the pile, coopered, weighed and made ready for removal by the buyer. Hogsheads vary in size from 38-50 inches in diameter and from 54-72 inches in height; and weigh from 1000-2200 lbs. according to size of cask and nature of leaf.

Tobacco growers in the Dark Export sections have perfected an organization known as the Dark Tobacco District Planters' Protective Association. The Association controls and operates a number of prizeries and warehouses and the growers are now able to market their crops in much better shape than formerly. The average planter cannot well grade his own crop according to the requirements of the buyers, especially export buyers, and only when a number of individual crops are gathered at a central point can the proper grading be done and each grade prized in a separate hogshead. Tobacco handled by this Association is sold by its officers, in its warehouses and according to its labels. During the active season the Association's prizeries are frequently visited by bonded inspectors to insure the work being honestly done and hogsheads correctly labeled. Quite similar in principle and purpose is the American Society of Equity. The movement is spreading and many local organizations amongst the growers are forming.

Of recent years the great buyers, The American Tobacco Co., the Imperial Tobacco Co. and the so-called "Regie" Governments, have been buying direct from the farmers' barns to some extent. Besides domestic leaf The American Tobacco Co. handles export leaf. The Imperial Tobacco Co. handles English export leaf. The "Regie" buyers purchase for those countries whose governments maintain a monopoly of trade in tobacco, viz: Italy, France, Austria and Spain.

Dark Export tobacco is exported chiefly to following countries: Great Britain, Germany, Austria, France, Italy, Belgium, Spain, Holland, Canada, Africa, etc. Each country differs as to requirements for and character of leaf desired. As the supply is drawn from practically one section of the country, considerable knowledge and experience is required to properly sort and grade the leaf.

Export tobacco is divided into three general classes, English, Continental and African, each having its minor subdivisions. The Continental types are the French, Italian, Austrian and Spanish "Regie," the German, etc. England and Germany take best grades, other countries inferior grades and the Spanish "Regie" trade calls for little if any good leaf. Of all the leaf exported Great Britain takes about 30% of bulk and 35% of value.

Some types of export leaf are made very black by steaming and "prizing" while hot. In addition to this oil is sometimes added during "prizing."

REHANDLING AND STEMMING TOBACCO.

Rehandling of tobacco after market is necessary to put the leaf in proper condition for distribution. The idea of the average grower has been to market his tobacco as quickly as possible. Consequently he has paid but little attention to the proper grading and conditioning of the leaf, leaving that to the rehandler. This rehandling consists in assorting and grading, drying, ordering and "prizing" into hogsheads. Tobacco marketed in so-called "farmers' order," besides being improperly graded, is not in condition to keep when packed in hogsheads. To properly condition it, the leaf is thoroughly dried to eliminate moisture, excess

sap, gum, etc., then cooled and "ordered" enough to be "prized" without breaking.

In addition to rehandling and because of high import duty English Export tobacco has to be stemmed, i. e. the midrib of the leaf removed, and "ordered" after drying to a moisture content of 10% (the legal minimum) as it is an expensive matter to pay duty on stems and water in the leaf. "Strips," as the stemmed leaf is termed, are mainly from Dark Export tobaccos, but White Burley and Bright Yellow tobaccos are gaining in favor.

These operations are generally carried on in buildings more especially adapted as of recent years than formerly, variously termed, Rehandling Establishments, Leaf Houses, Prizeries, Reprizeries, Ordering and Reordering Establishments and Stemmeries. The term Prizery is the most characteristic and concise of any applying to a plant occupied for rehandling tobacco. It is sanctioned by long usage and is derived from the word "prizing," the operation of packing tobacco into hogsheads, which word in turn is derived from the verb prize, "to raise or force with a lever" (Webster). Years ago all "prizing" was done by hand and various arrangements of levers used, and although hydraulic prizing is largely used today the old hand method still continues. Not always is the term Prizery quite apropos, as nowadays there are numerous modifications of old-time methods due to the advent of machinery. The leaf might be assorted and graded in one place, "prized" and shipped to a large central plant where it would be dried, cooled and "ordered" in great machines and again "prized" into hogsheads. Such a plant would be an Ordering Plant or Reprizery and that first mentioned a Prizery. Strictly speaking a Prizery is where the leaf is hung to dry by natural means and the "ordering" done likewise, after sorting and grading. However in the modern Prizery the leaf is not hung (except certain types) but is passed through a patent drying and ordering machine. The term Stemmery is always indicative of its occupancy. These aforesaid plants are intermediary between the grower and manufacturer and are operated by middlemen, dealers, export buyers and the like and by tobacco manufacturers themselves.

Modern methods of conditioning tobacco differ widely from those of former days. In those times months were consumed in drying and ordering tobacco. Today it is a matter of minutes, such have been the improvements afforded by the application of mechanical ingenuity to this branch of the tobacco business.

In the old-time Prizery, tobacco was handled about as follows: After being sorted and graded the "hands" of tobacco were put on sticks and the loaded sticks "shingled" in "bulk" until spring when they were hung up. The warm drying winds of spring would properly dry the leaf and after the humidity of a warm rainy spell about June it would be in good "order" for "striking." This was known as the "ordering season." As the tobacco was "struck" down it was "bulked" to preserve "order" for "prizing." Tobacco of certain types is conditioned in this manner today, which is termed "natural season."

But little different from foregoing were the methods of handling the leaf in Stemmeries of years ago except that stemming was added. The first improvement was to hang the leaf on sticks, or lay it on wire trays

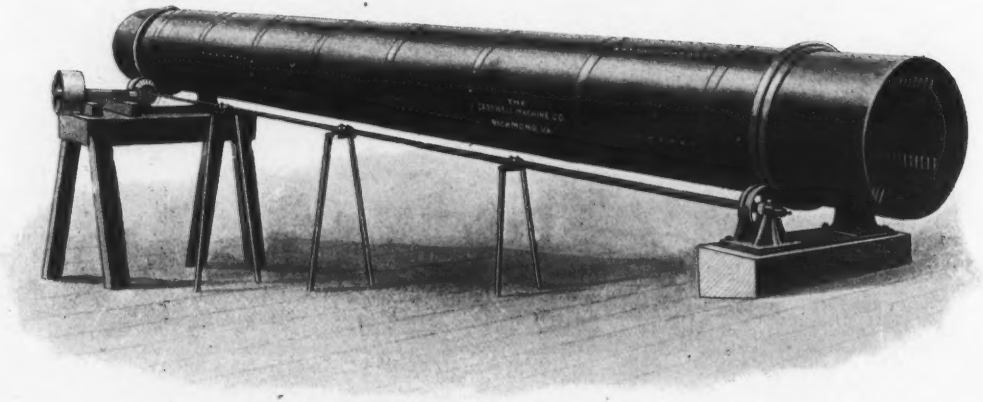
in a drying house and use artificial heat for drying either from steam pipes or from fire-heated flues at a temperature of 160° F. These drying houses were sometimes more than one story high to permit of large storage capacity and the floors were slatted to permit of free radiation of heat. After drying was complete the house was opened up and allowed to cool, then closed again and live steam admitted to put tobacco in "order" to handle. After "striking" and "bulking" the tobacco was further "ordered" in a steam box before "prizing," stick by stick. Further improvements developed step by step and now we have the highly perfected machine which has revolutionized the industry. Drying and ordering apparatus will be treated separately in another chapter.

In a modern Prizery tobacco is handled much the same as described below in connection with a Stemmery, except that the leaf is not stemmed.

An Ideal Stemmery.

Wilson, N. C., Branch, Imperial Tobacco Co., Ltd. View of third floor Main Building used for storage of stock after being received, weighed and graded by lots on first floor.

The manner of handling tobacco in a modern Export Leaf Stemmery is about as follows; Tobacco received in baskets from sales warehouses, weighed, roughly graded by basketfuls and stored in heaps to await stemming. Before stemming, the leaf is "ordered" by tumbling it inside a revolving cylinder open at both ends and slightly inclined into which is discharged a jet of steam. This moistens the leaf so that it can be handled and the stemming is then done by hand, the "strips" graded and bundled into "hands." These are straddled over sticks, "sticking" as it is termed, and put through a drying and ordering machine and finally "prized" into



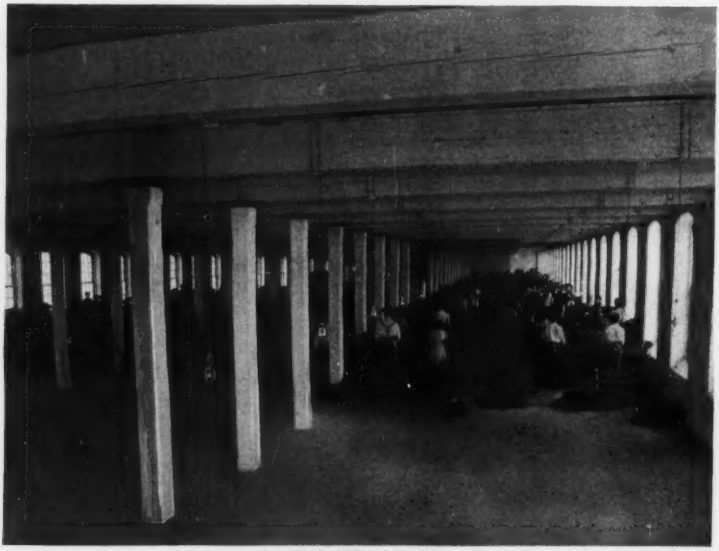
The Cardwell Tobacco "Ordering Drum."

Used for putting tobacco in "stemming order." Revolves on small driving wheels and by means of teeth inside tumbles leaf about and opens it up so as to be moistened by jet of steam which is directed inside. Tobacco fed in at upper and delivered in "order" at lower end. Usual sizes 36 inches in diameter and 24 to 36 feet long.

By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.

An Ideal Stemmery.

Wilson, N. C., Branch, Imperial Tobacco Co., Ltd. View of rear of second floor showing apparatus incidental to the preparation of tobacco for stemming, namely Ordering Drum and Sand Reel.



An Ideal Stemmery.

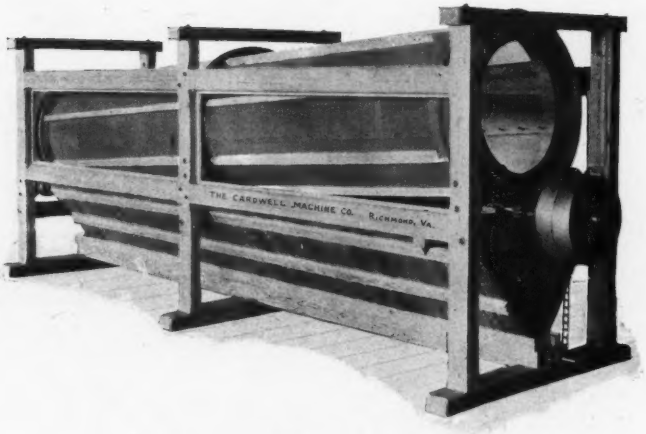
Wilson, N. C., Branch, Imperial Tobacco Co., Ltd. View of front portion of second floor showing operation of stemming the leaf by hand method.

An Ideal Stemmery.

Wilson, N. C., Branch, Imperial Tobacco Co., Ltd. View of Prizing Room where tobacco is packed or "prized" into hogsheads after passing through drying and ordering machine, discharge ends of which are shown to left of view.

hogsheads. Scrap tobacco resulting from handling the leaf is stored in bulk and when in sufficient quantity is cleaned in a sand reel and put through drying machines and "prized." The stems removed from the leaf are stored until sold.

Cigar Leaf Stemmeries. Preparation of tobacco for manufacture of machine-made cigars, cheroots, etc., is quite elaborate. The necessary preparatory operations are carried on in Cigar Leaf Stemmeries either connected with a cigar factory or isolated. Tobacco is received generally in cases. The cases are opened, the "hands" of tobacco shaken out, laid on a truck and sprayed with water. This spraying moistens the leaf enough to insure proper fermentation while in "bulk" on the truck in the Sweat Room. It stays in the Sweat Room for several weeks in a humid atmosphere kept at a constant temperature of 95° F. or so. The humidity is attained by evaporation of water in an open pan heated by steam. This period of fermentation conditions and improves the tobacco for use in cigars. Thence the trucks are moved to the sorting tables where the "hands" are untied, the leaves assorted and graded and laid on a conveyor belt which carries them to a "casing" machine. This machine as shown in illustration revolves and tumbles the tobacco while it is being sprayed with flavoring liquid. This at once flavors the leaf and puts it in "order" for stemming. Stemming may be done either by hand or by machine.



The Cardwell Tobacco Sand Screen.

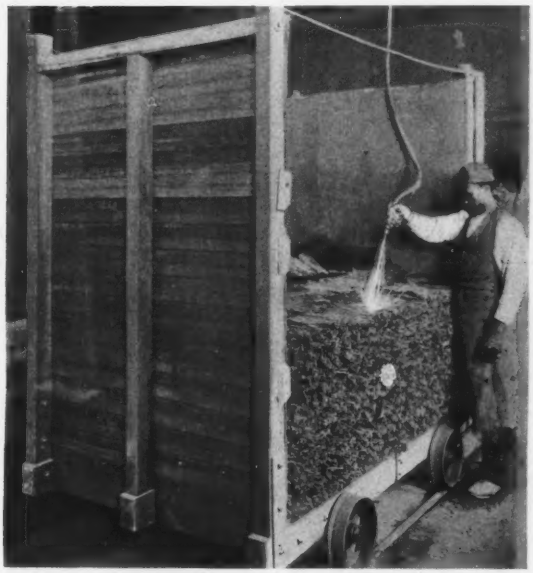
Used for cleaning tobacco of sand and dirt. It is a cylindrical screen revolving on small driving wheels. The teeth mounted in inner side serve to tumble leaf about and shake out sand and dirt as tobacco passes through. Size is 36 inches in diameter and 16 feet long.

By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.

If by hand, the leaf is folded and the stem stripped off, the action being quite similar to cutting the leaves of a book. There are several makes of stemming machines. Some cut out the stem, others tear it out. Those in use in stemming cigar leaf cut the stem out so as not to damage the leaf. The following is a description of the most prominent of these machines: The stemming mechanism consists of two cylinders of equal size set slightly apart on a common shaft. In the space between them revolves a cutting knife. The operative guides the leaf so that the stem passes under the knife and each half of the leaf is wound on each of the cylinders as the stem is cut. These strips, as the cut leaves are now termed, drop off into piles and when enough have accumulated, say 50 or so, the operative smooths the leaves out and folds the pile into what is termed a pad or book. The operation is termed "booking" and is subsequent to hand stemming likewise.

The "booked strips" are laid on wire trays on trucks adapted for them and dried in dry-rooms large enough for a number of trucks thus loaded. These rooms are variously arranged and heated generally by hot-air blast. (See Drying Machinery.) Temperature maintained is about 100° F. Drying is completed in several hours, the trucks withdrawn and the tobacco allowed to cool. When cool it is "ordered" in rooms similar in construction to the dry-room by moistening effect of steam spray which puts the tobacco in shape for packing. Packing is done in paper-lined cases and "strips" are shipped to various factories.

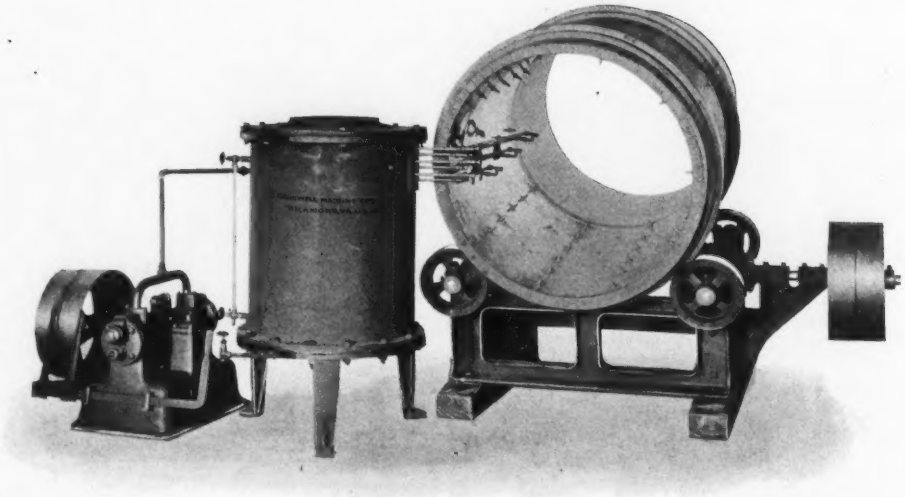
The scrap tobacco from Cigar Factories and Stemmeries is worked up



"Casing" or "Ordering" Cigar Leaf with Water Spray before "Sweating."

By courtesy of "Scientific American."

for use as cheroot and cheap cigar fillers. It is handled about as follows: "Cased" and "bulked" to ferment, dried and "ordered" in drying machine, picked over, again "cased" then cleaned in a revolving sieve and cut into uniform size in a special cutting machine. After this the scrap is dried, generally in Adt dryers, shaken over an oscillating sieve and packed into hogsheads. The waste resulting from working scrap is used for snuff and granulated pipe smoking tobacco.



Tobacco Machinery.

The Cardwell Tobacco "Casing" Machine.

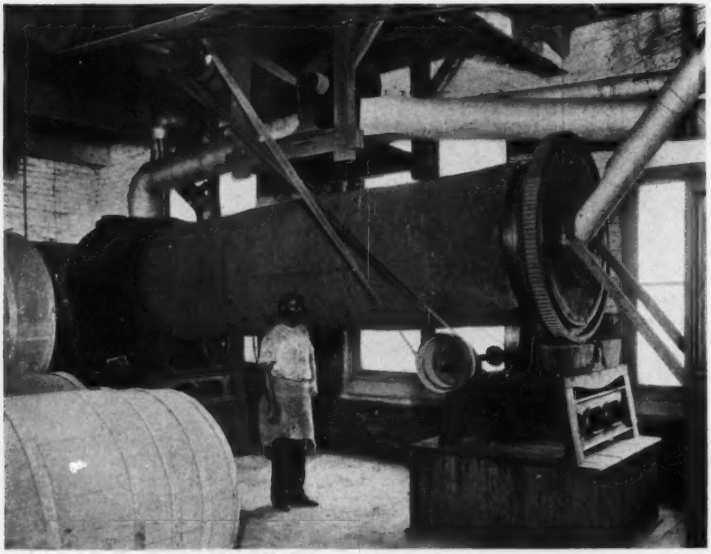
Used for flavoring leaf for cigars and plug tobacco. Drum revolves and teeth inside serve to loosen up leaf passing through. Flavoring sauces contained in reservoir at left. Air compressed by pump adjoining forces liquid from reservoir out through atomizers in revolving drum onto leaf.

By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.

Stemming Tobacco by Hand.
By courtesy of "Scientific American."

Stemming Cigar Leaf by Machine.
By courtesy of "Scientific American."

Drying "Booked Strips" for Cigars in Special "Truck Dry Rooms."
By courtesy of "Scientific American."



An Adt Dryer as Installed in a Southern Tobacco Manufactory for Drying Scrap Tobacco.
By courtesy of "Scientific American."

MANUFACTURING TOBACCO.

The several branches of tobacco manufacture are variously classified. In this paper it will suffice to use the following classification:

Smoking Tobacco.

Cigars, Cheroots and Cigarettes.
Pipe Smoking—Fine-Cut and Granulated.

Chewing Tobacco.

Plug and Cut Plug, also Fine-Cut.

Snuff.

SMOKING TOBACCOS.

Cigar Making.

Prior to 1870 the manufacture of domestic cigars was purely local. Most every town of considerable size had its cigar factory which supplied the local demand and the sale of the overplus extended to other towns in proportion to the enterprise of the manufacturer. Domestic cigars were first made in the Connecticut Valley. The first factories were established at East Windsor and Suffield, Connecticut, in 1810. In a few years Kentucky followed, then Ohio, Tennessee, New York, Pennsylvania, Maryland and Virginia. At first all cigars were made exclusively of the domestic leaf, but not for long as importation of Cuban tobacco soon began and today all high-grade cigars are made of either home-grown or imported Cuban tobacco fillers.

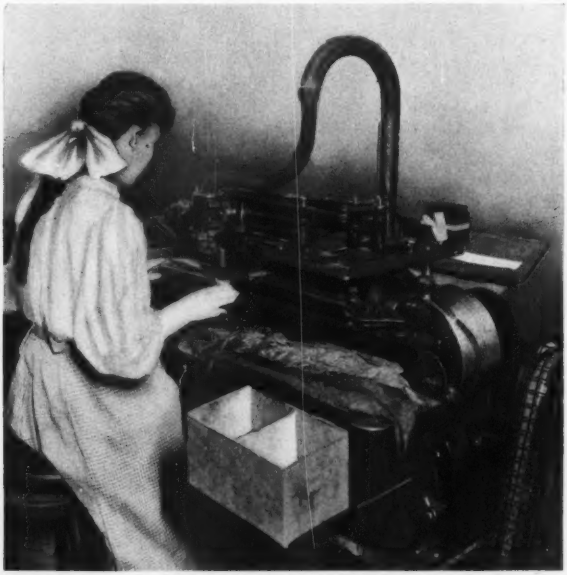
Since 1880 cigar manufacture has become better organized commercially and larger factories established. The advent of machinery in the industry has greatly revolutionized it. Today all cheap cigars, little cigars, cheroots and the like are machine-made. Cigars upwards of five cents in value are hand-made and aside from greater care, skill and understanding in preparation of the leaf for manufacture the methods of making the leaf into cigars are much the same as they were a hundred years ago.

There are two ways of making "hand-made" cigars; strictly by hand and by forming filler in a mould. Finer grades of cigars are made in the former way and cheaper grades in the latter way.

"Hand-made cigars" are made about as follows: Tobacco received from warehouses in cases or bales, opened, bundles of tobacco shaken out and "ordered" by spraying with or dipping in water. The Cuban method is to immerse in tubs of water containing saltpetre to improve burning qualities, and also at times sour wine, rum and other things for flavoring purposes. Next the leaf is sorted and graded into wrappers, binders and fillers and stemmed. "Strips" are "booked" as previously described and made ready for the cigar-maker. Generally the fine grades only of fillers are "booked," the inferior leaves being but partially stemmed and cast into a pile. The cigar-maker takes a "strip" from a pad of wrapper, spreads it out, and cuts it into one to three

wrappers according to excellence of "strip." A binder is taken from a "book" of "strips" of that grade and broken into a large and a small piece and these two pieces together are wrapped around a bunch of filler strips and rolled into shape by hand. The wrapper is next rolled on and pasted with gum and trimmed with a knife, thimble or by hand as in the Cuban shops. The cigar is shaped altogether by deft manipulation of the leaf by the cigar-maker.

Formed cigars are given their shape by bunching the "fillers" wrapping with "binders" and putting them in wooden moulds. These moulds are rectangular wooden blocks in which are cut depressions. These depressions are shaped as desired and number about twenty to the mould. The moulds when filled are subjected to enormous pressure for several hours which gives permanent "set" to the shape of the cigar.



Cigar Wrapping Machine.

By courtesy of "Scientific American."

After this the bunches are trimmed, wrapped and the finished cigars graded as to color and packed.

Machine-made cigars, cheroots, etc. Raw material consists of wrappers, binders and fillers prepared at the Cigar Leaf Stemmeries as previously described, also fillers in the leaf and short fillers (scrap, etc.). The extent of preparatory treatment of raw material varies in different factories, but the nature of it is similar to what has been described before.

The first characteristic operation in manufacturing this type of cigar is "bunch making." Long "filler" in proper quantity is laid on the

"binder strips" which are spread out on the rolling belt of the bunch machine. The operative starts the belt which swiftly rolls the "filler" and "binder" into shape, closely imitating the action of the human hand. When short filler or scrap is used it is contained in a hopper on the "bunch" machine and dropped automatically in proper quantity on the binder leaf on the rolling belt. After rolling, the bound "filler" is put into a mould which when filled is pressed as before described. The ends protruding from the moulds are trimmed off by machine and fillers made ready for wrapping. Wrapping is done on what is known as the "suction roller table." This machine has revolutionized the cigar industry. It cuts the wrapper, rolls it around the bound filler, pastes it and trims the ends, all without the aid of human hands except laying the wrapper on the cutting die and putting the bound "fillers" on the feeding mechanism. The machine while very interesting is most too elaborate to permit of a description here. The finished cigar is graded and packed into boxes.

Various brands, shapes, sizes, colors and qualities of cigars are described in Spanish terminology. The brands as Manuel Garcia, Henry Clay, etc., after a person of note, etc. Shapes as Conchas, Regalia, etc., Sizes as Perfectos, Finas, Speciales, etc. Shapes and sizes are generally combined, such as Conchas Finas, etc. Colors are described as follows: Claro, light; Colorado, dark; Maduro, very dark; Oscuro, extremely dark; Negro, darkest; the last two but little used. Intermediate colors are described by combinations of these names, as for instance Colorado Maduro, a shade between dark and very dark.

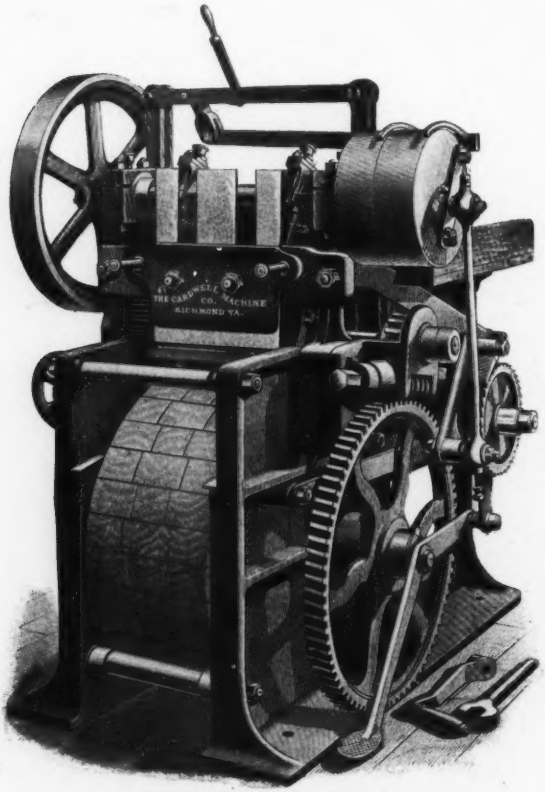
Cigarettes.

Cigarette more than cigar manufacture has been revolutionized by machinery. Cigarette machines are most all of American invention and represent highest attainments in mechanical skill and ingenuity.

Within the last thirty years the consumption of cigarettes has increased enormously. Such has been the apprehension regarding the deleterious moral and physical effects resulting from intemperate indulgence in cigarettes that certain state legislatures have enacted laws against the sale of them.

Over 90% of cigarettes produced annually are made in New York City, Richmond, Va., Durham, N. C., and Rochester, N. Y., all of which are machine-made.

Tobacco for cigarettes is especially mild and that for the best grades is several years old. The Bright Yellow variety of North Carolina and Virginia is most largely used. Process of manufacture is about as follows: Tobacco received in hogsheads from warehouses; opened, sometimes "sweated," then "cased" or flavored in "casing machine" which also puts it in "order" for handling. Glycerine is also used which serves to keep the cigarettes moist while awaiting sale. Next it is sliced into "long" or "fine" cut by suitable machines. The leaf as fed to the machine is compressed into a solid mass between rolls and neatly cut into shreds by a rapidly oscillating knife. Nowadays this "fine-cut" is dried and cooled in machines of the Adt type which serve the double purpose of drying and loosening up the shredded leaf by tumbling it about and making it light



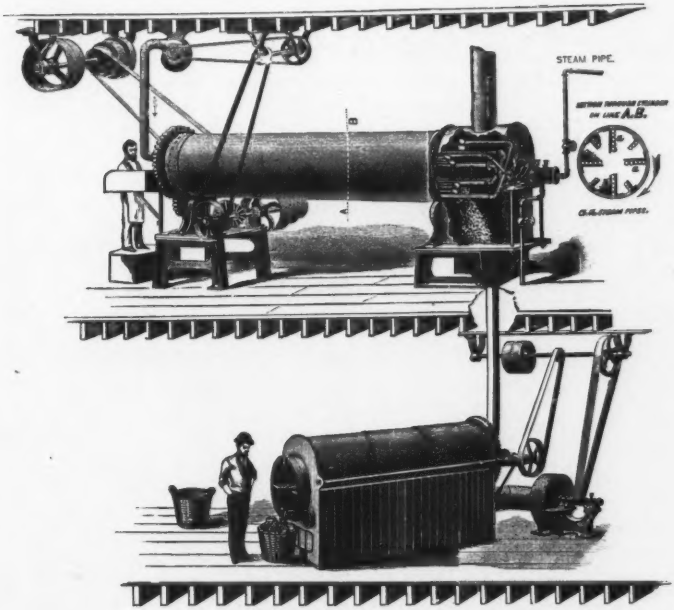
Columbian Tobacco Cutter.

Legg Pattern for Fine, Plug and Cigarette Cuts.

By courtesy of The Cardwell Machine Co., Richmond Va., manufacturers of Tobacco Machinery.

and fluffy. After laying in "bulk" for a few days the cut tobacco is ready for the cigarette machine.

There are several makes of cigarette machines and prominent among them are the Bonsack, Elliot, Universal and others. The Universal machine turns out ten cigarettes a second. The fastest machines work on the principle of enveloping a roll of tobacco in a ribbon of paper. The Bonsack machine is a pioneer and well-known type. The operation of it is about as follows: "Fine-cut" is fed to the machine on an endless belt. Over this belt at intervals revolve several pickers which comb out lumps in the tobacco before it reaches machine proper. As the tobacco leaves the belt it drops into a trough or groove formed by three rapidly



The Adt "Perfection" Steam Dryer and Cooler.

Dryer is a revolving cylinder of iron to the inner side of which are fastened a number of rows of systematically arranged steam-pipes which extend entire length of machine and act as paddles to carry tobacco to be dried through machine. Cylinder revolves on power-driven rollers at a speed of three to five r. p. m. Steam feed and return pipes have a common stuffing box outside cylinder. Dryer is covered with sheet felt to minimize radiation of heat. The Fan Blower under ceiling over feed end of dryer discharges into feed end and creates a current of air which carries off vapor generated in drying through vapor pipe at discharging end. Tobacco as dried drops to Cooler below. This machine consists of a revolving iron cylinder with screw-shaped paddles attached to inner side. In feed end of cylinder are placed wire screens which, in connection with exhaust fan serve to free dried leaf of dust, sand, vapor and heat.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.

moving endless metal belts and passing through forming wheels which gives it a rod-like shape, it runs through a circular orifice together with a ribbon of paper, and the paper wrapped roll passing on is pasted, printed, cut into desired lengths and the finished cigarette leaves the machine faster than one can count. After being tastefully packed in neat cartons the product is ready for shipment.

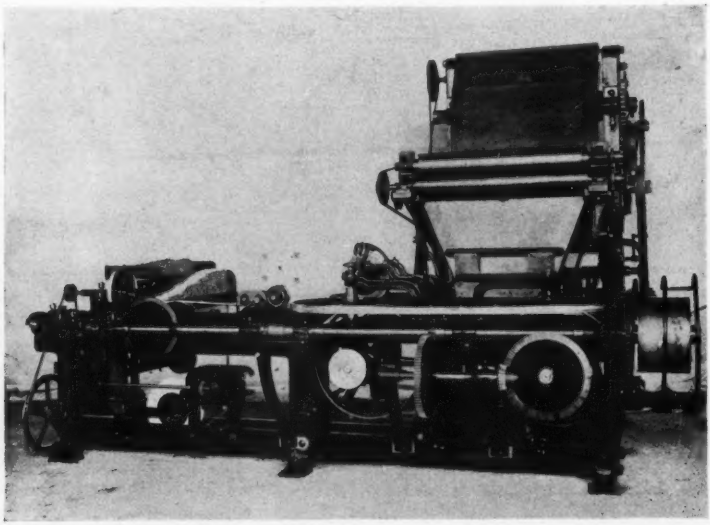
Pipe Smoking Tobaccos.

There are three general kinds of pipe smoking tobaccos in the market,

viz: "fine-cut" or shredded, granulated or flake and cut plug. The latter form, strictly speaking, belongs under the classification Chewing Tobaccos and thereunder will be discussed.

"Fine-Cut" has been described in connection with cigarettes. After shredding or cutting it is dried and "bulked" and packed for the retailers' shelves.

Granulated pipe smoking tobacco is manufactured about as follows: Leaf received in hogsheads from warehouses. These are opened, the compressed cylinders of tobacco broken up and pitchforked, generally, on an endless belt which carries it to the "breaker." The "breaker" is merely a revolving drum having thereon coarse teeth which serve to break up the large bundles of leaf. Thence the tobacco passes over a



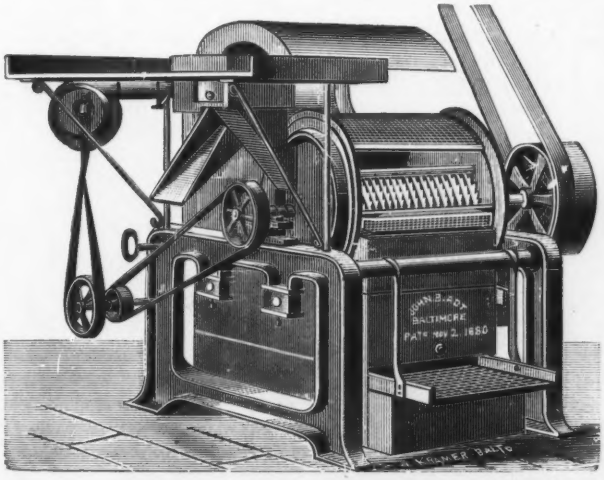
The "Bonsack" Cigarette Machine.

By courtesy of The United Cigarette Machine Company, Limited.

series of oscillating sieves of coarse mesh which shake out to a certain extent, dust, dirt and foreign substances, such as nails, sticks and other things oftentimes in tobacco. After leaving cleaning sieves the cheaper grades of tobacco are "cased" or flavored in a revolving "casing" drum. The flavoring sauces vary in nature in different manufactories, but are often composed of licorice, sweetening, rum, etc. The heavier ingredients are cooked into a syrup in steam-jacketed kettles, generally neatly arranged. Passing on the tobacco, flavored or not according to grade, is dried, cooled and "ordered" in a drying machine and conveyed by belt or otherwise to granulating machinery.

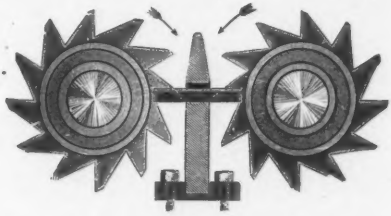
There are various arrangements of granulating machines. In general they consist of a granulating or cutting device, a series of sieves, which

separate granulated smoking tobacco from stems, dust and fibres and in some machines a blower fan is added to assist in eliminating objectionable matter. A granulating outfit observed in a large factory consisted of a number of machines arranged in series and all enclosed by wooden partitions to minimize escape of dust. The first machine had a coarse tooth cylinder which broke up the leaf fine and as it progressed through the train of machines the cutters being graduated in fineness,



Adt Tobacco Granulating Machine.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.



Detail of Cutting Device Adt Tobacco Granulating Machines.

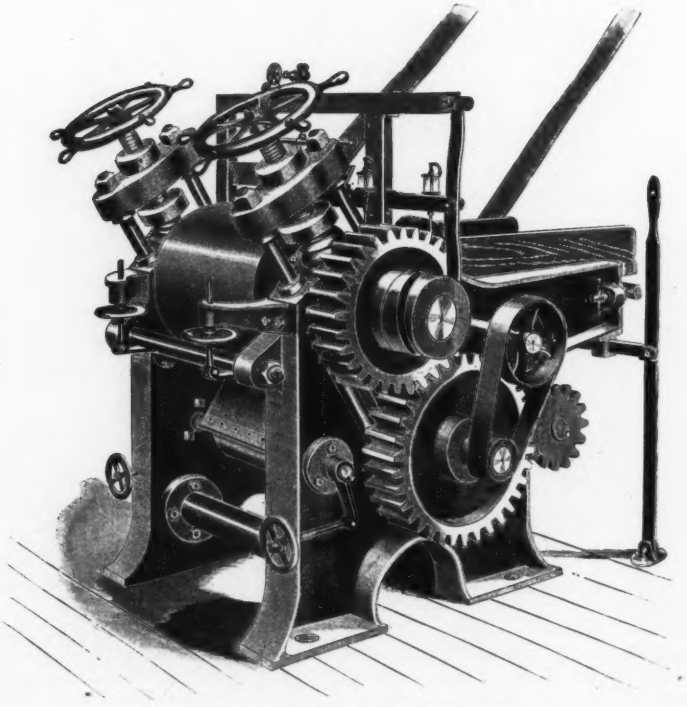
By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.

it became reduced to the size desired. After passing through each cutter the tobacco was shaken over a series of sieves which separated the cut tobacco, sand, dust and stems and the coarse uncut leaf was conveyed to next machine in which the operation was repeated and so on to the last machine.

Of the several types of granulating machines on the market one

prominent among them is the Adt Granulating Machine which is illustrated herein. The tobacco before reaching the cutting device is cleared of nails and other foreign matter while passing through the feeding chute by aid of magnets and a blower fan. The cutting device, also illustrated, consists of two sets of steel saws mounted on two shafts set parallel to each other, and revolve toward one another by aid of suitable gearing, the saws running between the teeth of the "cutting comb." In other machines the teeth of the revolving members are variously mounted on cylinders. The cutting device in the Adt machine is enclosed by a cylindrical sieve which revolves around it and by means of a suitable plate attached to the inner side continually elevates and drops the tobacco in the cutting device until it has been reduced to the required size when it passes through the mesh of the sieve, thereby completing the operation within the machine. Under the revolving sieve is attached a double vibrating sieve which rids the granulated tobacco of sand and dust, etc.

To resume our journey with the now flaked tobacco. From each of the machines of the outfit before referred to as having been actually observed, tobacco of smoking size is collected and conveyed to the "Bin



The Adt Tobacco Stem Rolling Machine.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.

Room," where it is dumped into box-trucks, weighed and is then ready for "casing." Dust from the machines is collected and cleaned in a "bolting-reel," sacked and shipped. Stems are conveyed to stem rolling machines which flatten them out as thin as paper and after being dried, generally in the Adt type of dryer, these flattened stems are run through the granulating machines. A well-known Stem Rolling Machine made by Adt of Baltimore is herewith illustrated. Briefly, the machine consists of two steel rolls with very hard surfaces carried in a stout frame and held together by strong springs. The rolls, revolving as they do against each other, carry the stems through and the great pressure exerted by the springs flattens them out. The rolls are kept cool by moistening them with water. A machine like this will flatten a ton of stems in a ten-hour day.

The better grades of smoking tobaccos are "cased" or flavored after being granulated. It is spread out on the floor and the flavoring sprinkled over it from a sprinkling can by hand or it is "cased" in a machine. There are various flavoring concoctions, but rum, tonca beans and licorice predominate. Tonca beans are milled and mixed with tobacco. Licorice is prepared in steam kettles. In large factories quite a considerable stock of spirits is kept on hand.

After casing, the tobacco is stored in bins to age. When ready for packing it is fed to hoppers of automatic weighing and packing machines which automatically fill and "label" the sacks of tobacco and affix revenue stamps. The filled sacks are packed in strawboard cartons and shipped.

CHEWING TOBACCO.

It might be of interest at this juncture to state that it is said that the citizens of the United States smoke largely and chew more. After the Dutch they are the greatest consumers of tobacco in the world, the annual average per head being five pounds. For chewing and skill in expectoration, the American is more famous than for smoking. His dexterity in spitting has been recorded with awe by Dickens.

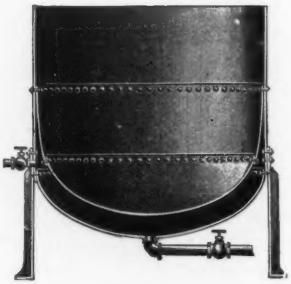
Plug tobacco is composed of "filler" leaves and an outside wrapper and is manufactured about as follows: Tobacco in hogsheads received from warehouses. In some factories leaf is received from sales warehouses and handled as has been described in connection with Prizeries and stored in warehouses to age. Hogsheads stripped from contents, which are broken up and "ordered" in an "ordering drum." In some factories the leaf is "sweated" for awhile instead. The "hands" are then untied, assorted and graded and stemmed. The "strips" are dipped into a flavoring sauce of licorice, glucose and artificial sugar, cooked in steam-jacketed kettles, and passing through a wringer which squeezes out excess liquid enter drying machine. The "dipped filler" as it is now termed is thoroughly dried, cooled and "ordered." Further flavoring is added in a "casing" machine as the "dipped filler" leaves the drying machine and after this it is "bulked" to age for several days. Wrapper "strips" are treated similar to "fillers."

Having been sufficiently aged in "bulk" the "strips" are sometimes again "ordered" in an "ordering drum" and if destined for chewing plug, passed on to the Lump Room. Here they are weighed and formed into "lumps" or plugs in so-called "lump forming" machines. This puts

Improved Steam-Jacketed Licorice Kettle.

Used for cooking licorice, sugar, etc., used in flavoring sauces for different kinds of manufactured tobacco.

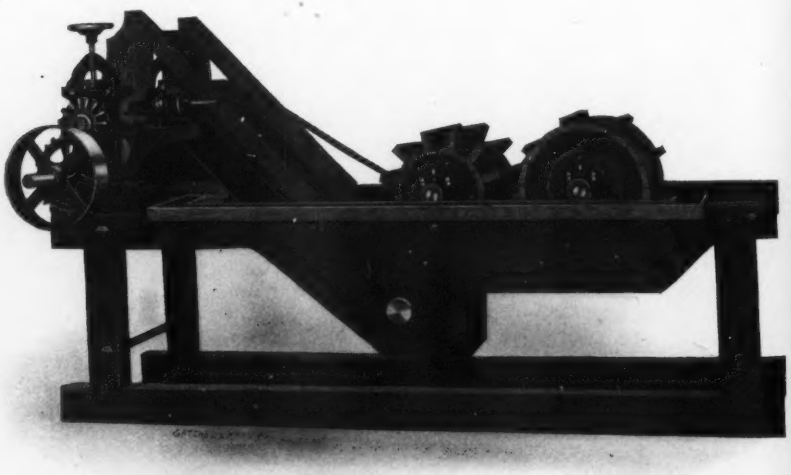
By courtesy of The John H. McGowan Co., Cincinnati, Ohio, manufacturers of Tobacco Machinery.



CROSS SECTION.

Improved Steam-Jacketed Licorice Kettle.

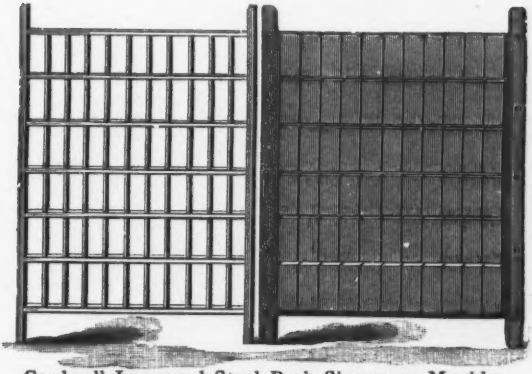
By courtesy of The John H. McGowan Co., Cincinnati, Ohio, manufacturers of Tobacco Machinery.



The Cardwell "Model" Dipper and Wringer for Plug "Strips."

"Strips" are dipped in flavoring sauces by rotary paddles and carried on endless belt to wringer rolls, through which they pass to drying machine.

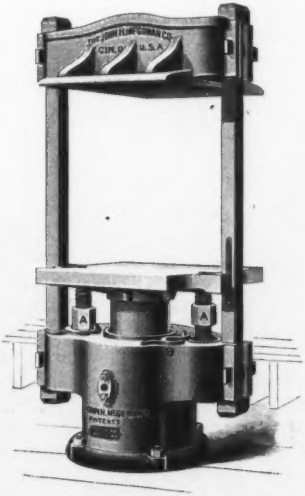
By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.



Cardwell Improved Steel Back Shapes or Moulds.

These are used to shape plugs of tobacco while in Mould Press herein illustrated.

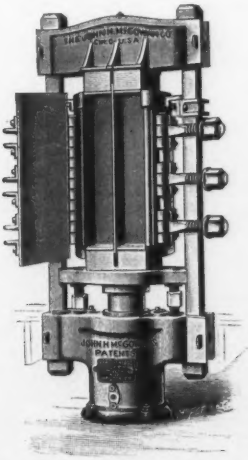
By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.



McGowan "Monitor" Mould Press.

Used in shaping plug tobacco. Press operated hydraulically. Held in position or "set" by swinging links "B" under nuts "A" in retaining screws and screwing nuts down.

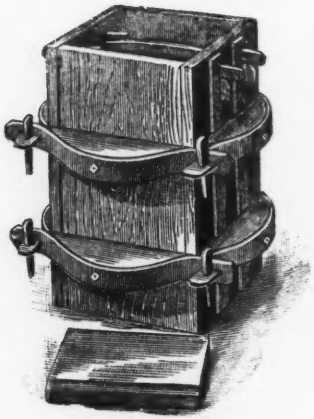
By courtesy of The John H. McGowan Co., Cincinnati, Ohio, manufacturers of Tobacco Machinery.



McGowan "Monitor" Double-End Compartment Finisher Press.

After being "shaped" or "moulded" in Mould Press as shown, the plugs are pressed and held in Finisher Presses which gives finish to the plugs.

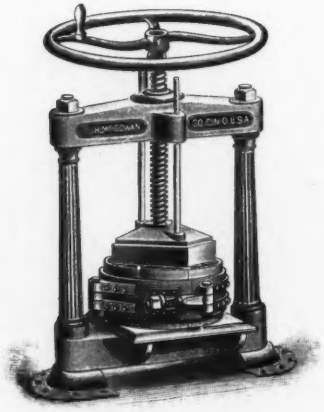
By courtesy of The John H. McGowan Co., Cincinnati, Ohio, manufacturers of Tobacco Machinery.



Cardwell Gum or Lump Retainer.

Used in holding plug tobacco during "sweating" after pressing.

By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.



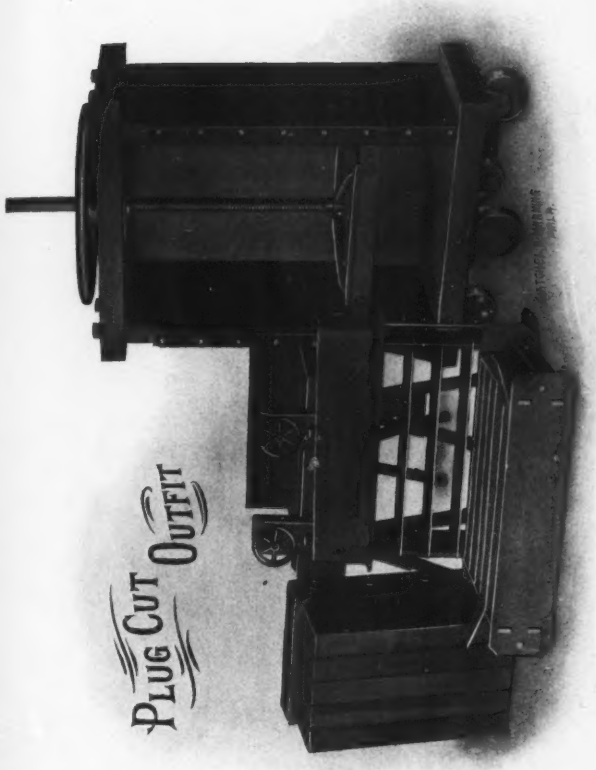
McGowan Hand Wheel Boxing Press.

Used for pressing plug tobacco into boxes.

By courtesy of The John H. McGowan Co., Cincinnati, Ohio, manufacturers of Tobacco Machinery.

the tobacco in shape for wrapping which is done by hand on tables adjacent to the "forming" machine. The wrapped "lumps" are dried at a moderate temperature to eliminate excess moisture and passed on to the Press Room. Plugs are first pressed in moulds or "shapes" to get shape desired. This is done in the "Mould Press" which is herein illustrated, as are also moulds or "shapes." The final pressing in the "Finisher or Pot Press," (see illustration) settles the tobacco, makes it perfectly solid and gives the plugs a high finish. Next the plug tobacco is packed in "Gums" or "Lump Retainers," illustrated herein, which keeps it in shape to ferment and gives it permanent set. After a period of fermentation the plugs are dried at a moderate temperature in various styles of machines, tagged and pressed into boxes. A form of "boxing press" herein illustrated. In this shape it is ready for shipment to market.

Cut Plug or Plug Cut tobacco is prepared in the same manner as Plug tobacco. After "bulking" and consequent "ordering" as described it is pressed or "prized" into slabs by hand-power screw or power presses and these slabs sliced into the width necessary to fit the plug cutting machine by a machine similar to a paper cutting machine, or the tobacco is packed into shapes in which by means of top and bottom blocks, known as "head" and "bed" blocks, it is pressed into large coarse plugs ready for the cutter. The tobacco cutting machines slice the plugs transversely with either vertical oscillating or rotating knives. A machine of the former



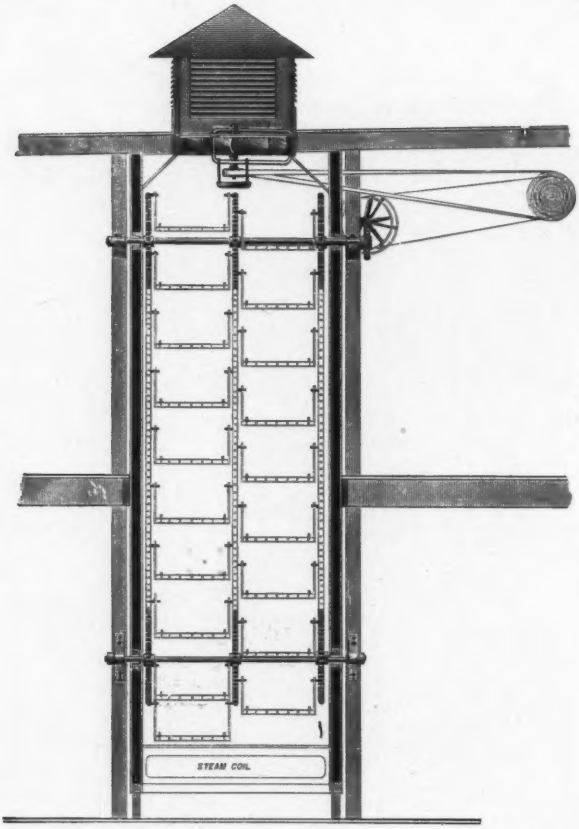
Crimpers, Shapes, Head and Bed Blocks, Division Plates and Hand Press for Making Cut-Plug Tobaccos.

By courtesy of The Cardwell Machine Co., Richmond, Va., manufacturers of Tobacco Machinery.

type is herein illustrated. The sliced tobacco is dried in various types of dryers and then packed, the packages, sometimes automatically, stamped, labeled, dried and cooled and then shipped. Plug Cut is used for smoking as well as chewing.

Fine-Cut tobacco, also termed "long-cut" is prepared in the same manner as was described in connection with manufacture of cigarettes. Packing for shipment is often done automatically in a machine which makes the package, weighs contents, fills package and closes it.

Twist tobacco is made by rolling well-moistened leaves lengthwise on a table and feeding it to a spinning machine which spins it into a tight roll and passes it through rolls to a twisting spindle which gives it the final twist. Another form of twist is "nips" made from short rolls of leaf, rolled and twisted by hand.



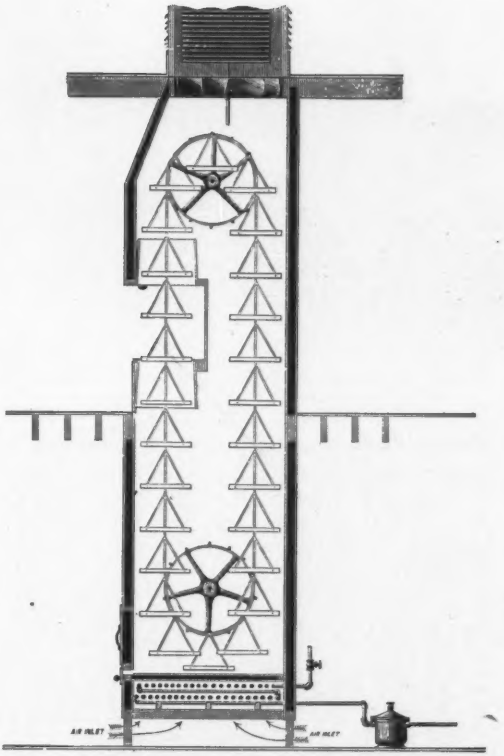
The Adt Plug-Cut Tobacco Dryer.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.

SNUFF.

The manufacture of snuff is more or less elaborate and complicated corresponding to the character and grade of the desired finished product. There are two general classes of snuff in the market, dry and moist. The following are the four principal kinds of snuff; Scotch, or "eating" snuff; Maccaboy or "inhaling snuff;" Sweet snuff; and Salting snuff.

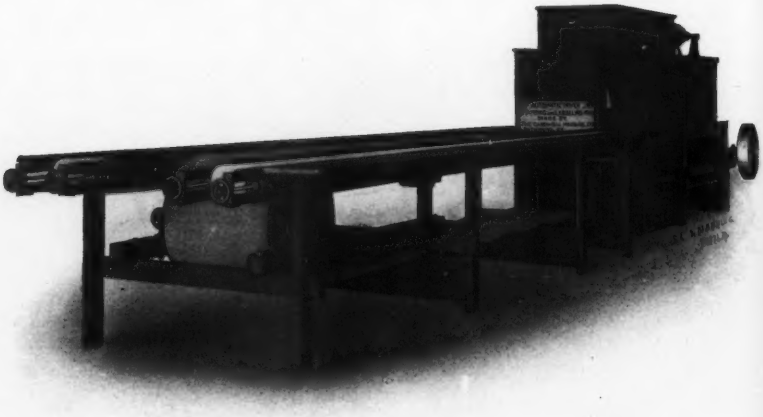
Method of manufacture is approximately as follows: Raw material for better grades generally "lugs" or lower leaves of the tobacco plant. It is first aged for several years in the snuff factory warehouses. After



The Adt Plug-Cut Tobacco Dryer.

Machine consists of endless chains running over toothed wheels, attached to which are pivoted carriers in one or more rows, carrying light trays of wire cloth on wooden frames; and steam-coils below protected above by wire screen to arrest whatever falling tobacco there might happen to be. Apparatus is enclosed by wooden partition, which might extend through several floors. Air intake is at bottom and fan at top of room serves to exhaust air and generate necessary circulation. The motion of the machine is very slow.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.



Cardwell Automatic Stamping, Labeling, Drying and Cooling Machine.

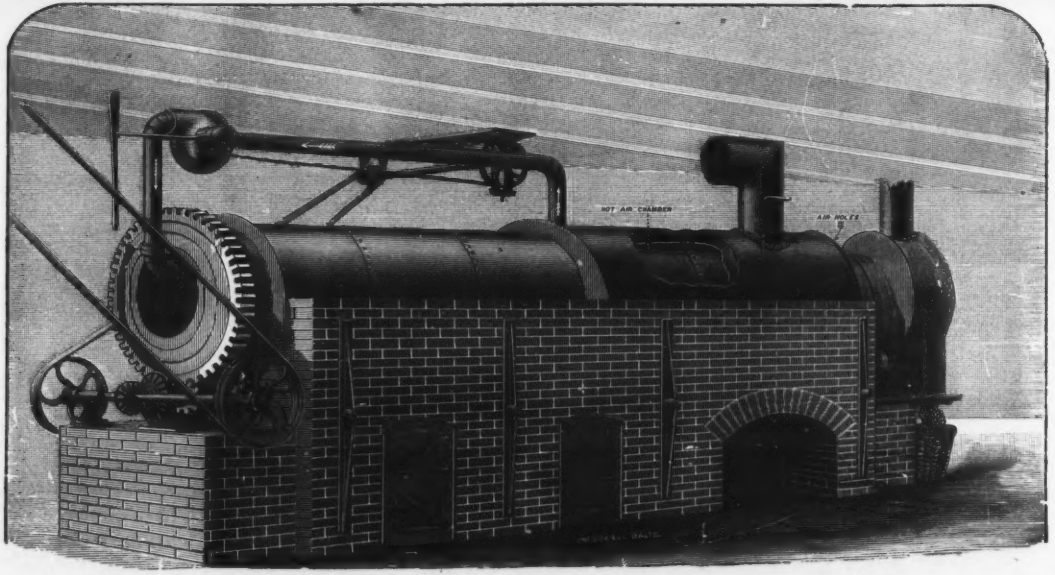
Used for completing necessary operations on packages of plug-cut and fine-cut tobacco.

this it is coarsely cut in a machine, "ordered" and "reprized" into hogsheads to ferment or sweat. This is done several times before it is ready for desiccation and consequent pulverizing, the tobacco being unpacked, "ordered" and "reprized" each time. Following this it is dried or toasted, either in the type of furnace toaster as illustrated herein, or, as was observed in a certain factory, by being shaken from one tray to another underneath and so on down in a brick steam-heated room, at a high temperature.

Next follows the grinding. The grinding machines or "mulls" are conical iron pots, shaped like an inverted frustrum of a cone, about 20 inches high and 36 inches in top or greatest diameter. The "mulls" are lined with heavy chilled corrugated iron linings; a heavy vertical shaft by means of suitable carrier arms supports three chilled rolls or "chasers" which revolve around their own axis and also against the corrugated lining of the "mull" thereby pulverizing the toasted tobacco into a fine powder. The "mulls" are supported on a base plate resting on heavy timbers, being of considerable weight. Upon leaving the "mulls" the tobacco, now snuff, is elevated to a cleaning reel through which it passes and descending to the automatic packing machines is packed and shipped.

IRA G. HOAGLAND, *Inspector,*
South-Eastern Tariff Association.

(Concluded in next issue.)



Adt New Improved Furnace Dryer and Snuff Toaster.

Consists of a revolving iron cylinder with four screw-shaped paddles attached inside. The cylinder is encircled by four bearing rings which revolve on grooved rollers and sets in a breeching of brick in which are the heating furnaces.

By courtesy of John B. Adt, Baltimore, Md., manufacturer of Tobacco Machinery.

Fire-Proof Buildings.

INSPECTION WHILE IN PROCESS OF CONSTRUCTION.

The increase in buildings of fire-proof or "fire-resistive" construction has been most marked of late. In the larger cities buildings of this class are springing up almost daily. We know from past experience that buildings can be built which are "fire-proof" at least to the extent that they will remain structurally intact even when subjected to a severe conflagration. On the other hand we know that through faulty construction or design the damage to such building may be much greater than with what we may designate as a "standard" fire-proof building and furthermore the effect of such a building as a fire stop in case of exposure or conflagration fires may be very much lessened on account of these same defects.

Also when we consider the individual fire-proof risk and the internal fire we find that in many cases the fire spreads from floor to floor owing to faulty construction, and the damage to building by these local or internal fires is much greater than it ought to be.

Thus we have fires spreading from one floor to another because of unprotected floor openings, pipe holes, etc. We have the steel work exposed to heat with possible buckling due to poor insulation or improperly secured. We have floor arches giving way on account of faulty construction or material. All of which simply emphasizes the fact that a "fire-proof" building to be worthy of its name must be properly constructed in all its details.

The building should be designed and constructed in full conformity to the Rules and Regulations of this Association in order to obtain the best results. This means proper workmanship as well as proper design and the former at least will seldom be obtained without proper supervision. Perhaps the best, if not the only way to obtain this supervision, is by frequent inspection by those familiar with buildings of this class who can detect poor workmanship or weaknesses in the construction details. It is evident that inspection by a disinterested party should be of much value and in some localities the insurance or local board inspector follows more or less closely the erection of fire-proof buildings sometimes to great advantage of the property owner who naturally desires to have good workmanship and to avoid all defects.

While such an inspector would not ordinarily be called upon to criticise the general design of the building he should be familiar with many of the details and experience in some cities has already shown that such an inspection may be productive of great good. Some of the more common defects are holes in floors for piping or conduits, breaking of the insulation and leaving openings sufficiently large for fire to spread from one floor to another or water to run through. Faulty insulation improperly fastened. Partitions weak and not secured to ceiling. Incomplete insulation of columns or girders, etc., etc.

Mr. Henry V. Thayer, Acting Superintendent of the Boston Board of Fire Underwriters, is one of our members who has specialized on tne inspection of "fire-proof" buildings and the remarks and notes that follow are submitted by him as covering in a general way the chief points to be reported upon.—*Editor.*

The developments in the construction of buildings by the use of non-combustible materials in place of wood have produced a marked

change in the probable damage by fire in most cities. With this has come a demand, entirely proper if based on proper knowledge of the subject, for reduced rates of insurance on such buildings and their contents, and to some extent, for reduced rates on other buildings through reduction in the exposure hazard.

This question of reduced rates has naturally brought about the necessity for detailed information as regards the individual risk and experience in this direction has already shown that in many cases the data at hand is entirely inadequate.

As a means of obtaining such data the inspection of so-called "fire-proof" buildings in process of erection is most important, as in no other way can the details of construction and the quality of work be ascertained and recorded in such manner as to be of real value.

The inspector who undertakes this work should be well versed in the different methods of construction and able to judge as to the quality of workmanship and materials used, but for the present at least it appears advisable if not necessary for him to confine his criticisms to workmanship and materials and not to venture to enter the field of design.

The questions of the arrangement and method of constructing floors and supporting members and the factor of safety may be left to the architect and engineer, subject of course to the building laws governing in the place where the building is located.

The following features of construction should be noted:

Foundations:—Whether piles, concrete, stone masonry, grillage.

Walls.—Whether skeleton, cage or carrying floors.

If skeleton, note thickness each story and manner of support on frame.

If cage, note thickness and tieing to frame.

If carrying floors, note thickness, and anchoring of beams.

Columns—Steel or cast iron.

If steel, note construction, whether box, Z-bar, plate and angle or special section.

If cast-iron, whether square or round and thickness of shell in each story, and whether core is concentric.

All columns should be faced off on the ends perpendicular to the axis, and (for steel) provided with proper splice plates. Cast iron columns should be faced off as above and set vertical without the use of wedges.

Girders.—Note girders carrying exterior walls, whether plate, box or compound beam, and interior girders in the same way—giving size in inches and weight per foot.

Beams.—Note size and weight of beams and distance between.

Floors.—Note (if terra cotta) the thickness of blocks, whether side or end construction, hard, semi-porous or porous, flat or segmental arches and quality of workmanship in laying. The arches should be laid true and straight with all joints well filled with cement mortar and proper size keys used. Broken tile should not be used, nor should slabs be used instead of keys.

Concrete Floors.—Note brand of cement, composition of mixture, i. e. parts of cement, sand and broken stone or cinders; method of mixing (hand or machine) and appearance of mixture when placed on

forms. Note character of metal reinforcing members and minimum of concrete covering metal.

Upper Floors.—Note the construction of upper floors, whether plank with wearing floor above, 7/8 inch double or 7/8 inch single and whether or not sleepers are used. If used, the space between them should be filled in with concrete—preferably a cinder mixture.

There should be no air space under the finished floors.

Insulation Features.

Exterior Columns.—Note the material used, whether brick, terra cotta, concrete or metal lath and plaster, the thickness and manner of applying.

Interior Columns.—Note as above and whether or not steam or other pipes are included within the insulation.

Note carefully that column insulation extends entirely to ceiling and masonry floor in all cases.

Girders.—Note material used as for columns.

Beams.—Note whether (if terra cotta floors) full skewbacks or half skewbacks and beam plates are used. If concrete floors, whether concrete haunches and metal lath and plaster on flanges, concrete slabs or moulded concrete.

Partitions.—Note material of partitions whether terra cotta, metal lath and plaster (single or double) plaster blocks or concrete.

Note thickness, and whether or not set on masonry floor.

Note door and window frames in same, whether wood or iron.

Finish.—Note doors, if solid wood or glazed, with or without toplights.

Note hallway finish, whether wood, marble or plaster.

Stairs.—Note whether open or enclosed. (If enclosed, in what manner) construction, whether iron, concrete or Guastavino tile. If of iron, note treads whether iron, marble or slate, if marble or slate whether or not iron webs or plates are provided under same.

Elevators.—Note whether open or enclosed (if enclosed, in what manner).

Elevator Doors.—Note whether standard fire, metal clad panelled, iron, wired glass or grill.

Floor Openings.—Note if any openings in floors, as for pipes, conduits, dumbwaiters or similar purposes, and how protected.

Roof.—Note roof covering and pent houses—how built.

Note whether any space between ceiling of top story and roof, and whether structural metal in same is insulated as required.

With complete and careful notes as outlined above and a general memorandum as to the care and skill employed in the erection of a building we will have a fair basis by which we may compare the risk with others of its kind. Moreover, the comparison of such notes with a study of the results of the Baltimore conflagration and other destructive fires in buildings of this class will become more than ever a means of predicting the probable results of a fire of greater or less magnitude in cities where such buildings are becoming common.

In addition to this the possibility of obtaining improvements or eliminating defects during construction is of greater advantage for

after the building is finished the defects are almost always covered up and remain a menace to the risk.

As examples of the above we can note the following defects which have been frequently discovered and corrected during construction:

Unprotected metal in the space between ceiling of top story and roof.

Column tops which are intended to be covered by ornamental capitals, and not properly insulated before same are put in place.

Pipe holes which may be concealed by upper floors.

Broken terra cotta tile caused by careless cutting.

HENRY V. THAYER, *Acting Superintendent,*
Boston Board of Fire Underwriters.

Automobile Garages.

A comparatively new problem presents itself in the consideration of the fire hazards of the automobile garage. Experience and statistics have but little to teach in this connection as the last five years have virtually witnessed the birth and development of this class of risk, so that a limited opportunity only has presented itself for the compilation of facts and figures, and insurance interests are still in doubt as to actual conditions and the best means of meeting them. Automobiles may be divided into three classes:

First, the electrically driven machines which present the least fire hazard of any;

Second, the volatile oil vapor driven machine which is hazardous; and,

Third, the steam driven machine which is most hazardous of the three.

The simple storage of these classes creates very little danger of fire except from a possible leaky gasolene tank, so that we must look to the questions of **handling, repairing, testing, and cleaning machines,** also storage of volatile oils, filling of tanks and occupancy of the garage for the hazards of fire in connection with this class of risk.

Buildings.—Buildings of standard fire-proof construction and not over five stories in height with all floor openings protected and without turntables in floors, and floor areas subdivided by fire walls, present the best type of structures for this class of occupancy. Buildings of ordinary or frame construction are not suited to this occupancy. All boilers for power or heating should be in separate buildings not communicating with main structure. If, however, it is found necessary to have boiler room in building the room should be of fire-proof construction with walls and ceiling of not less than 12 inches brick with no openings permitted to main garage. Access to boiler room to be by outside doorway. No dynamo or gas-engine should be permitted in or under rooms where gasolene is stored or handled. All exposed artificial lights should be eliminated from building.

Heating should be permitted only by steam or hot water. Repair pits should be of fire-proof construction and drained and ventilated to outside of building. The entire building should be so constructed that all floors are freely ventilated so as to insure a continual change of air.

Handling.—As far as possible machines should not be run into the building under their own power, and in no case should a steamer or a steam-driven machine be propelled in the garage. In this latter class the flame which is necessary to generate the steam is as hazardous, and even more so owing to its proximity to the floor, as any other exposed light in the building, and while perhaps the securing of an honest observance of this requirement would be a difficult task, yet efforts in this direction should be determined and continuous. In some of the earlier makes of steam machines, gasolene torches were

used to start flame under boiler, and in all cases where this type of machine is stored especial care should be taken that the machine is removed from building before attempting to generate steam.

The cleaning of acetylene lamps and the removing and renewing of carbide should always be done outside of building and under no circumstance should the residue from an acetylene lamp be thrown on the floor of a garage.

Repairing.—If repair work is done in building, shop for same should be so located that forges, etc., shall not expose any possible gasolene fumes. All machines before being taken to repair shop should have volatile oils removed from tanks and no gasolene should be permitted in the room.

The use of extension electric wires in repair room is to be condemned, as such a wire coming in contact with the sparking attachment of a machine may cause a flash and a fire. Where such extension lights are used only extra cable should be installed, and lamps should be fitted to keyless sockets and protected by wire screen over bulbs. No cut-out switches should be permitted in rooms where gasolene fumes are liable to accumulate. Testing of motors should always be carried on outside of garage, as the sparks of the machine may ignite gasolene fumes.

Cleaning.—The almost universal practice of cleaning or washing automobile parts inside of garage with gasolene cannot be too strongly condemned. There are perhaps but few garages and repair shops where this is not done, even in close proximity to exposed flame; and while explosion and fire consequent on this course may by a fortuitous chain of circumstances be delayed yet it is inevitable. Should it become absolutely necessary to so cleanse certain parts of the machine, the automobile should be removed from the building far enough away in the open air as to warrant that no fumes shall find their way into the garage. This work should not be done on the roof of the garage, owing to the well-known fact that the fumes of gasolene are heavier than the atmosphere and therefore in all likelihood would find their way from the roof into the building.

Storage of Volatile Oils.—The violations of good and safe practice under this heading are too numerous to mention, therefore it will be well perhaps to endeavor to formulate some general principle which should govern the storage of volatile oils rather than to attempt to enumerate these violations. In the first place all gasolene and similar volatile oils should be stored in good heavy tanks sunk under ground as far from the garage as practicable. Tanks to be of ⅜ inch boiler iron tested to 100 lbs. per square inch and coated on outside with tar; and all connections for filling and pumping to be made in top of tank; and the tanks to be encased in a concrete covering on all sides and over top at least 12 inches thick to prevent as far as possible leakage and consequent filtering of the oil through the ground into cellars. Where it is necessary to place the tank under ground in close proximity to a building under which there is a cellar or basement, the top of tank should be sunk below the level of such cellar or basement so as to eliminate the danger of drainage from a possible leak. Pressure systems and gravity flow for volatile oils are both to be condemned, as the presence of oil in pipes inside of building is not

good practice and in case of a leaky pipe or valve oil may find its way into the building. In cases where there is no yard room for the storage of gasolene, it may be stored under the sidewalk subject, of course, to the local rules of the city and in accordance with the general condition suggested. We shall not undertake to suggest specifications for the detailed construction of tank and connections as the subject is too broad, but have only hinted at what we believe to be a good general plan to follow as to supply tank.

The best method for handling oil from tanks is by an approved pumping system and whenever the physical conditions will warrant it the pump should be placed in a fire-proof building outside of the main structure and not communicating therewith. If, however, it is absolutely necessary to place the pump inside the building a fire-proof room or closet should be constructed securely cut off from garage and ventilated by a brick flue extending at least six feet above roof of main building, said flue to have metal double gooseneck cap so arranged that openings in same shall be at least 10 feet from any exposed windows. This flue to be built from floor and to have openings at floor and ceiling inside of pump room not less than 6x6 inches and all openings in flue and gooseneck to be protected by fine brass wire screen.

Storage tanks for volatile oil should be filled from outside of building and pipes for filling same should not pass through any portion of the garage.

Tanks of machines should not be filled inside of the building, but should it be imperative to so fill them, a filling station should be constructed about 20 feet from entrance of garage. The station to be of fire-proof construction and cut off from balance of building, and all machines to be brought to this point of the garage for filling. If this arrangement is not practical, a portable metal tank, mounted on wheels, of about ½ barrel capacity, filled from main supply tank outside of building and having a screw cover over filling opening may be provided for the gasolene. This tank should have a registering pump attachment with tube to fill automobile tanks. A movement is on foot on behalf of the committee on automobile garages of the N. F. P. A. to secure an agreement from the makers of all automobiles to provide a standard size for filling openings on all auto tanks, so that in an arrangement like the above a filling cap may be attached to the tube having a return tube from cap which will carry the fumes back to the portable tank, thus making it impossible for the fumes to escape into the building. In lieu of a standard size cap the suggestion was made at the last meeting of the National Fire Protection Association that a cone cap covered with leather so as to insure a perfect fit might be provided which would fill the above requirement where a standard size for the filling opening is not obtainable. If it should be considered impracticable owing to small size of garage or because of other features to use the above described portable tank a five-gallon safety can may be substituted but it is not good practice to use them. Whatever may be the means of filling auto tanks neither cans nor portable tanks should be allowed in garage when not in actual use but should be stored outside of the building.

As to general condition in building care should be exercised in

the matter of storage of calcium carbide and "Prest-o-lite tanks" the former should be stored strictly in accordance with rules of the National Fire Protection Association, and in reference to the latter the tanks should be so stored as to obviate the possibility of being exposed to high temperature in case of a fire; that is, they should never be stored inside the building as the sudden expansion of the gas consequent to a rise of temperature in case of fire, may cause a disastrous explosion. It would perhaps be well, if it is imperative to store these tanks inside of the garage, to provide a vault under ground where the danger of high temperature would be reduced to a minimum, and in fact even if stored outside the building an underground vault would perhaps be the best safeguard against explosion. A strict prohibition against smoking inside the garage should be enforced and as far as possible the carrying or use of matches in the building should be strictly ruled against. Floors should be kept swabbed clean of all accumulation of oils or gasolene and the proper disposal of oily waste insisted upon. All unnecessary assembling of individuals in or about the garage should be discouraged and only those employed about building or owning machines in same should be permitted inside.

In reference to fire protection an abundant supply of sand pails should be provided in all rooms where gasolene is stored or used. In the balance of the garage water pails present the best means of controlling a fire. There have been cases where compressed air has been very successfully used to blow out a fire ignited by a sparking motor. Automatic sprinklers have also been very successful in not only holding a fire in check but in completely extinguishing it even when large quantities of gasolene were exposed in open receptacles within a few feet of the blaze.

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Chief of Special Hazard Dept., New York Fire Ins. Exchange.

Combination Heating and Ventilating Systems.

The practice of combining heating and ventilating processes into a joint system is based upon that principle of physics which demonstrates the difference in gravity between cold (or foul) air and that of heated air; the former being the heavier tends to fall, while the latter from its lightness tends to rise, these differences in density serving to create currents of opposite direction, whereby the ascending current of heated air displaces the cold or foul air, which then falls to the level of the floor of any enclosed space, where from its density it would remain stratified unless displaced by agitation or by liberation through vents at its level.

Hence in all scientifically planned combined heating and ventilating systems where natural forces are utilized as means of operation, the vent ducts for the escape or removal of cold or foul air are located at the floor level of an enclosure, and when properly installed, insure successful accomplishment of the purpose intended, even if in arrangement and construction such system may not always present conditions promising immunity from fire through the faults of design and installation.

Experience has fully demonstrated that the important feature of fire hazard has not generally influenced the design and introduction of such systems, this being particularly true in relation to the conditions found to exist in the average school house and church structure, as well as in many public halls, court houses and the like, where it is not at all unusual to find wood ducts or conduits in use, not only for conveying the outer air to the base of the heating furnace, but also as flues for conveying the heated air to points of distribution, and for the removal of the cold and foul air from the heated enclosures; this practice in either of its phases is most reprehensible, and under intelligent supervision and regulation is never sanctioned, while in advanced communities such practice is in violation of the law and subjects the responsible violator to prosecution and penalty on conviction.

Under this method of heating and ventilation are to be found two distinct systems respectively known as the *"direct"* and the *"indirect,"* under the former the foul and dust-laden air is carried from the floor of the rooms through ducts or flues by action of the heated air currents which displace the foul, and these flues deliver the foul air above the roof of the building, thus securing the direct ventilation which serves to indicate the method and where such system is properly installed it presents the least hazard of these combination systems.

The "indirect" system, such for instance as the "Smead System," seeks to secure the removal of all foul or cold air, not only from the area of the room enclosures, but also from all of the hollow spaces surrounding the same, including the spaces between the floor joists and the partition studding; to accomplish this end, the area of space between the floor joists is increased by nailing 2x4 wall strips across the joists, and openings are made through partition walls from the

joist-channels to the spaces between the studs, thus providing a complete maze of communicating horizontal and vertical spaces, accessible to flame while inaccessible to means of extinction, the whole presenting a most cunningly devised means of insuring rapid combustion and destruction of the building in case of fire.

In some instances the above objectionable features of the "indirect" system are found to be materially aggravated by the presence and use of the so-called "dry-closet" system (Smead System), in the operation of which excreta from the toilets is destroyed by burning with the aid of volatile or highly combustible material such as gasolene or kerosene oil for fuel, hence, where the "indirect" system is in use, with or without the "dry-closet" attachment, we prefer to decline the risk absolutely.

As it is entirely within the bounds of commercial practice to install these combination systems in a manner which will markedly minimize, if it may not entirely eliminate, the danger of fire now so evident in general practice, there is no good reason why such precautions should not be insisted upon in all cases, whether the installation be new or old, and we therefore submit the following suggestions as being based on good practice in relation to construction and installation of such systems.

Heating Furnaces should in all cases be erected upon a solid foundation of brick or stone, with hearth of brick, stone or cement not less than 36 inches wide in front of the ash pit. The top or dome of the furnace, and also its smoke-pipe, should not be less than 18 to 20 inches from unprotected woodwork or lath and plaster, and its side walls should be at least 12 inches from combustible material.

Smoke-Stack or Chimney should be built of sound, hard brick on a solid foundation, with double walls well bedded in cement mortar and having an air space between the walls, with all joints inside of flue carefully pointed; or may be single walled, not less than eight inches thick, enclosing burned clay smoke-flues, or if without such smoke-flues, walls must not be less than eight inches thick and all joints, both inside and outside, should be as carefully "pointed up" as would be called for in a pressed brick front. Stack should be carried four feet above the roof, and all timbers or woodwork exposed to stack should be framed around same, leaving an air-space of not less than two inches on all exposing sides.

Hot-Air Ducts should preferably be entirely of brick or hard burned terra cotta tile, properly insulated from contact with woodwork or other combustible material, but may be constructed of expanded metal and plaster or of bright charcoal tin; properly supported and insulated by air-space of not less that two and one half inches from all exposed woodwork in either case, and if constructed of tin, to be made double with an air-space of not less than one half inch between the inner and outer flues when passing through or within wooden or lath and plaster partitions.

Foul-Air Ducts should be constructed in same manner as suggested for hot-air ducts, but may be installed with not less than one inch clear space to woodwork. Ducts should not be connected directly with heating furnace nor any hot-air or smoke-flue, but preferably to a special flue adjoining a brick smoke or hot-air flue carried to the same

height, but separated therefrom by not less than four inches of brick work. (The radiated heat from the smoke-flue will thus induce an upward current in the foul-air duct adjoining.)

If foul-air ducts be not connected to smoke or hot-air flue as above suggested, they should each empty into a vertical flue of proper construction, which should extend above the roof of the building, in which case the bottom of the flue could be left and an upward current be induced by the heat from the furnace room, or by location of an open gas flame at base of flue.

Hot-Air Registers, when placed in wooden floors or wainscoting should be set in soapstone frames not less than two inches wide, well set and embedded in plaster of Paris, Register boxes where passing through floors or wainscoting should be made of bright charcoal tin, having joist or floor timbers framed around them to leave a space of from two to two and one half inches on all sides according to the size of the box, the exposed woodwork to be covered with bright tin on all sides, extending from under the soapstone frame to and under the ceiling or open joist below.

At least one register of any system should be always kept wide open, either by the removal of the vanes or by securely wiring the valve to prevent its being closed.

Cold-Air Ducts should preferably be entirely of brick, metal or other non-combustible material, but may, under approved conditions, be of wood up to a point not closer than five feet from inlet base at furnace, from which distance the construction should be entirely of brick, metal or other non-combustible material. The duct should extend to the outer side of the building wall and be provided with wire net or grating at that point.

As the average installation of heating and ventilating apparatus is seldom found to closely conform to the above suggestions for safety, there may be cases where the deviation from the lines laid down are of such minor character as to not seriously increase the fire hazard beyond that of the nature of their surroundings and in such instances the judgment of the inspector should be exercised as to the proper course of action, always taking the benefit of a doubt on the side of caution where proper remedy cannot be promptly secured.

In the average district or village school house the most frequent deviations from safe practice will usually be found to lie in the character of the material used in the construction and the arrangement of the foul-air ducts or flues or the trunk flue conveying air to the fire-box of the furnace or heater, and in illustration of such conditions we cite the following instances of dangerous practice as developed by recent inspections.

(1). **Foul-Air Flue** (vertical) discharging under the roof in attic, thus providing means by which fire would very quickly reach the most inaccessible portion of the structure and gain headway before discovery. Such arrangement should serve to condemn the risk, whether the flue be non-combustible or of wood, as in either case the accumulation of dusty and fluffy flyings would serve to feed a flame.

(2). **Foul-Air Duct,** leading from outlets at floors above the heating device to the base of same at fire-box. The method here noted is essentially dangerous, as falling embers from the furnace grate are

liable to ignite the dust, paper or other refuse which accumulates in the duct, and thus convey fire to the building. Where such conditions exist they serve to condemn the risk, whether the foul-air flue be of wood or of non-combustible material.

(3). **Foul-Air Flue** (horizontal) passing under the ceiling from the floor outlets above the furnace room and opening into the smoke-flue of the heater stack or chimney; arrangements of this character may well be classed as exceptionally hazardous, as the heated air of the smoke-flue serves to carbonize the accumulation of dust, flyings and other refuse adhering to inside of foul-air duct, and will eventually ignite same, while a rising spark from a newly kindled fire in the furnace is almost sure to cause such ignition and carry flame to the interior of the structure, hence, the presence of such conditions will render the risk unacceptable.

(4). **Foul-Air Flues** (horizontal) passing under the ceiling of heater room or cellar and emptying into open room. This practice presents an unnecessary open ended flue by which fire would rapidly pass into the structure and be difficult to extinguish, and while this condition is not as hazardous as the instances above cited, it is sufficiently objectionable to warrant severe criticism and demand for the use of non-combustible material in construction of the flue with a wire screen at its outlet. The method is unsanitary.

(5). **Hot-Air Flues,** when constructed of wood, serve to condemn the risk entirely.

(6). **Cold-Air Duct,** when entirely of wood up to entrance of furnace shell, presents a feature of hazard but slightly less objectionable than the deviation noted under citation No. 2 and for the same reasons a demand should be made for substitution of non-combustible material for a distance of five feet from the furnace shell.

In conclusion, every effort and argument should be used by the inspector to bring all heating and ventilating installations up to the standard of safety above outlined wherever possible and to secure improvements or changes in arrangement where such action may result in making the outfit reasonably safe, bearing in mind that intelligent explanation of the defects and of remedies for same, together with firm insistance for compliance to safe practice, will in many instances bring about the desired reforms.

F. M. GRISWOLD, *General Inspector,*
The Home Insurance Co., New York.

Editorials.

It is with much regret that we learn of the illness of our president, Mr. W. W. Dudley of Chicago, and we extend to him our best wishes and hope for his speedy recovery.

It would seem unnecessary to state that this Association has nothing to do with insurance rates or with fire cost. It is not an insurance organization and makes no attempt to compare risks in the sense of determining how much better one type is than another or to estimate in dollars and cents the probabilities of fire loss. Article No. 2 states its object so clearly that it can hardly be misunderstood by any one who reads it at all carefully and yet we have frequent inquiries as to what rate ought to be charged for some particular risk or how to reduce the rate. We cannot even advise as to how to obtain the lowest insurance rate, and all our Association attempts to do is to give the best information at its command in all matters pertaining to fire prevention and protection and by issuing Rules and Standards give a definite basis by which a property owner can construct or protect his property. Our object is "to promote the science and improve the methods of fire protection: to obtain and circulate information on this subject and to secure the co-operation of its members in establishing proper safeguards against loss of life and property by fire."

One of the means by which we circulate information is through the "QUARTERLY." Our endeavor is to improve conditions and the knowledge as to how to improve conditions comes not only through individual investigation but by finding out how others have solved the same or similar problems. We wish to know what you, as an individual, are doing in improving conditions, how you are meeting the many live issues which are continually being presented. The problems are so numerous and often so complex that they require special engineering skill or careful investigation and what has been worked out in one case may be of much value elsewhere. The problem of city fire protection and prevention is naturally of great importance and some of the features may be briefly enumerated, such as proper building laws, regulations for handling and storage of inflammable liquids and explosives, high pressure fire systems, window protection, etc., etc. We wish to know how these problems are being met in various localities. Mention is made elsewhere of tests on the high pressure fire service just completed in Cleveland, Ohio, giving some information as to how this problem has been handled in that city.

It is felt that the members of this Association must be more or less interested in each others welfare and that personal items relative to business changes, special investigations, etc., would be worthy of a place in the Quarterly. This applies both to active members and individuals. The appointment of special committees by active members, if pertaining to fire protection or prevention, can be reported to the Editor for publication and now that our membership includes so

many diversified interests the opportunity of interchange of opinions or information becomes much greater.

Locomotive Sparks. Many of our members are well aware of the enormous fire loss caused by sparks from locomotives and yet few have probably given the subject any particular attention. The fact that any radical changes or improvements tending towards the reduction of this fire loss lies primarily with the railroad companies has doubtless led the fire protection experts to feel that the problem is more or less out of their jurisdiction. On the other hand is it fair to assume that the railroads are not open to suggestions, or that they have done all that can be done? Have the railroads as a whole investigated the subject from an engineering standpoint and if not can our Association be of any assistance? Doubtless some railroads have spent time and money looking towards a solution of the problem, in fact we know such to be the case, but anything which has such an important bearing on the fire loss of the country as a whole certainly deserves our serious consideration. The fire records of manufacturing risks which have already been published show a very material percentage of fires from locomotive sparks and yet taken as a whole we would not consider manufacturing risks as particularly susceptible to the spark hazard and if we had figures on fires in shingle roof buildings, lumber yards, etc., located near the railroad tracks the spark hazard would doubtless be even more in evidence. The record of fifteen classes of manufacturing risks shows 29 fires from locomotive sparks out of 1092 fires from known causes, being approximately 3% of the whole. It has been suggested that a committee be appointed to investigate this subject and doubtless sooner or later some action will be taken along this line.

Large Loss Sprinkler Fires. (Where sprinkler control is satisfactory.) One of the subjects classified in the Fire Record of Sprinklered Risks is what is designed as Large Loss Fires where the sprinkler control is satisfactory. We find that many fires are promptly extinguished or properly held in check by sprinklers and yet the actual loss is considerable due to any one of several causes. An investigation of these causes would seem to be of much value in that it shows us how to guard against and perhaps largely avoid these important losses. In the classifications of the Fire Record Committee a "large loss" in a sprinklered risk is generally considered as any loss in excess of $5,000, this however not being any exact amount but dependent somewhat on the value of the property subject to loss in the particular case in question. For instance, with a small risk of $40,000 to $50,000 total value a loss of $3,000 to $4,000 might be classed as large while with a large risk of a million or more the $5,000 loss might be considered as small. Generally speaking however the size of the risk is not given any particular consideration and a loss of approximately $5,000 or more is classed as large, it apparently being the general opinion that in practically all risks the sprinkler system should control a fire with a less loss than $5,000, assuming that the various matters of construction, alarm service, etc., are properly arranged and provided.

Before commenting on the various conditions which are shown to bring about large losses with satisfactory sprinkler control we will summarize these fires as given in the Fire Record of various classes published to date, giving the number of large loss sprinkler fires (not of course including the fires where sprinkler control was unsatisfactory) together with the predominating cause to which the large loss is attributed.

	Causes.	No. of Fires.
No. 1.	Lack of proper alarm service,	8
	a. Fire department failed to respond.	
	b. No watchman or sprinkler alarm.	
	c. Thermostats and sprinkler alarm failed.	
	d. Delay in discovering fire by watchman.	
	e. Noon fire with no one at hand.	
	f, g, h. No watchman and defective sprinkler alarm.	
2.	Exposure fires,	6
3.	Fire in unsprinkled portions,	5
	a. Fire spread to unsprinkled basement.	
	b, c, d, e. Fire in unsprinkled additions.	
4.	Obstructions to distribution,	4
	a. Stock piled around sprinklers.	
	b. Storage of books.	
	c. Piles of cardboard.	
	d. Large cutting tables.	
5.	Delay in shutting off water,	4
	a. Poor arrangement of gate valves.	
	b. Afraid fire was not out.	
	c, d. No one knew how to shut off water.	
6.	Generally defective sprinkler system,	3
7.	Defective construction,	3
	a. Floor openings.	
	b. Fire spread to concealed spaces.	
	c. Poorly constructed grain elevator.	
8.	Special Hazards,	2
	a. Hot air blower system opened a large number of sprinklers.	
	b. Dip tank fire opened many sprinklers.	
9.	Fire department hose streams,	2
	a, b. Unnecessary water damage from hose streams.	
10.	Especially susceptible stock,	2
	a. Printing establishment.	
	b. Silk goods.	
11.	Defective check valve,	1
	Tank overflowed.	

In commenting on the above causes of large loss fires, while many features are self-evident it may do no harm to emphasize the more important points.

1. The lack of proper alarm service is accountable for eight large losses or about one quarter of the whole. It is of course evident that if there is no proper method of giving alarm, such as a watchman, sprinkler alarm, or thermostats, the sprinklers may put out the fire and then run a long time before any one is the wiser. Furthermore we have the same result if the alarm service fails for any reason. Some thermostat systems and sprinkler alarms are thoroughly unreliable and are more than likely to fail to operate properly as has been the case in several instances. Also with watchman service there may be considerable delay before fire is discovered. The value of a reliable alarm service is shown by the tables to be of great importance.

2. Exposure fires are of course bound to cause heavy losses in sprinklered risks unless all wall openings have standard protection. The lack of shutters or wired glass has in many cases been directly responsible for serious losses by smoke or water even where fire has finally been controlled with the aid of the inside sprinklers.

3. Serious losses are bound to occur where fire starts in unsprinkled portions and such fires of course place the sprinklers at a great disadvantage. The moral is self-evident—to place sprinklers throughout all portions of plant.

4. Obstruction to distribution is accountable for four large losses and this appears to be chiefly a case of poor management or carelessness. How can the water be properly distributed or reach the fire if stock is piled around or close to the sprinklers? The rules call for a clear space of one to two feet below the sprinkler. In some cases it is of course impracticable, if not impossible, to prevent obstruction to distribution of the water as with stocks of goods in piles, also benches and tables, but it is probable that were this defect more fully appreciated by the property owner the conditions would be materially improved. The need of sprinklers under all large tables, benches and shelves is also emphasized by the fire record.

5. Delay in shutting off water was accountable for four large losses. From a study of these fires it would seem that in some cases at least the property owner, the fire department, or other interested parties are not properly posted as to the location of shut-off valves and what to do at time of fire. Much time is lost trying to find the proper shut-off valve. In some cases the valves are poorly arranged or located. In one fire it was necessary to shut off three valves in various parts of the property before the flow of water could be stopped.

6 and 7. Where the sprinkler system is defective or where the construction is poor (unprotected floor opening, concealed spaces, etc.) it is evident that the fire is more liable to spread, opening up more than the average number of sprinklers and causing an abnormal loss. Such conditions would not of course exist in a properly constructed and equipped property.

8. Certain hazards such as blower heating systems and varnish dip tanks are also liable to open a large number of sprinklers and cause a heavy water damage even if the fire itself is held in check.

9. In two cases it is reported that the fire department used an unnecessary amount of water from hose streams and while in some instances this criticism may be a just one, it can hardly be classed as other than an error in judgment and the mistake might easily be made

in the other direction. It is possible that a better understanding of the automatic sprinkler on the part of some of our fire departments might cause them to place greater reliance on this device, tending towards putting out fires more cheaply, it being evident that the small automatic hose stream, i. e. the sprinkler, is generally more efficient and less wasteful of water than the large department streams.

10. It is of course difficult to extinguish fires cheaply when they occur near or among goods especially susceptible to water damage, such as silks or books. An efficient fire patrol may minimize the loss but such conditions must tend towards expensive fires.

11. The one instance where the water from pump overflowed a tank owing to a defective check valve while unusual is worthy of attention. If pump is frequently tested, the condition of check valve would be determined for an excess pressure could not be obtained unless check is properly seated.

While the above relates only to the "large loss fires with successful sprinkler control" similar conditions frequently lead also to unsuccessful sprinkler fires where the fire gets beyond control of the sprinklers.

High Pressure Fire Service. High pressure water supply systems for fire service have already been installed in several cities and other cities have the question up before them. As is well understood such systems generally consist of large mains of extra strength fed by pumping stations or fire boats capable of supplying large volumes of water at heavy pressures. New York City is installing such a system at an enormous cost and while the value of such systems is generally understood and recognized the practical results obtained must be of great interest. Recent occurrences in Philadelphia and Coney Island call attention to defects which while perhaps obvious and well recognized nevertheless give added weight to these features.

In the Philadelphia fire it was reported that the high pressure main in Market Street was exposed and spread apart or burst cutting off the high pressure main for about forty minutes, until valves necessary to cut out this break were closed. During this interval fire gained headway. It is of course evident that where pipes are in any way disturbed, as might be the case with street excavations, it is essential that such pipes be properly strengthened and supported. It is however particularly necessary with high pressure service pipes and more than ordinary care is required both when first laying the pipes and also in the case of any excavations as in the case noted. Furthermore this fire shows the need of underground shut-off valves to cut out small sections in case of break and these cut-off valves should be located and arranged so that they can be quickly closed in case of need, for a few minutes delay may be disastrous.

The Coney Island fire was interesting chiefly because of the lack of men to properly handle the high pressure hose streams. The high pressure system was fed by three pumps which took water primarily from the service mains or low pressure system and secondarily from salt water. It appears that when the first pump is started it takes away most of the pressure from the low service rendering the latter

of no value for hose service and not until the third pump is started do they all draught from the salt water. With this arrangement the low service streams which might be of value at the start of a fire and which are easily handled would be put out of commission. Reports state that there were insufficient men to handle the high service streams so that while the system is good for some fifteen streams only three or four can be used at the outset and it is stated that some thirty minutes elapsed before all of the streams could be brought into play. This of course simply emphasizes the need of a sufficient number of available men who can be called out promptly and who know how to handle heavy pressure streams. Furthermore the need of proper and adequate auxiliary apparatus was shown, such as monitor wagons, water towers, and nozzle holders, these features being of great importance when handling large volumes of water at heavy pressures.

The expense of a high pressure system is of course considerable and this money may be easily wasted unless the problem is thoroughly worked out and means provided for promptly and efficiently handling the hose streams.

Cleveland High Pressure Service. The Cleveland Inspection Bureau have recently issued a report on a test of the High Pressure Fire Service Water System just installed in that city. The system is part of an elaborate plan to afford additional fire protection to the congested district by means of separate systems of water mains for high pressure hose service. The Bureau in 1904 made recommendations for a high and direct fire service system in the congested district from which we quote as follows:

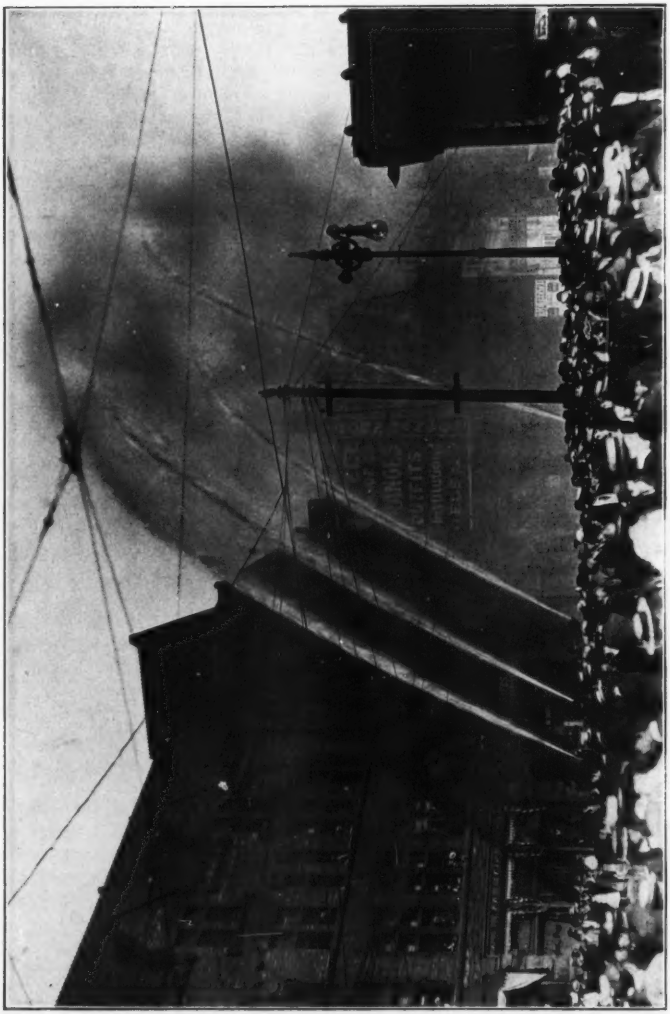
"To complete the present Fire Boat service, to meet the city's demands and rapid growth, the following carefully planned and economically arranged high pressure system is suggested: Such a system should afford excellent protection to life and property of all principal blocks in mercantile districts, and also to the principal manufacturing districts; should furnish a high pressure service with a maximum pressure of 200 lbs. per square inch at hydrant outlets; supply should be from two independent sources, and should be ample, at any time, to protect the boundary herein described with forty available 2½ inch fire streams, in addition to service of city steamers. Briefly, these sources would be that of the two fire boats, acting as one source, and independent high pressure pumps at Kirtland Street station; the fire pumps affording a source of water supply from eastern terminus, and fire boats from western terminus of the entire system."

This has been largely carried out with the exception of a separate pumping station, the two fire boats being the present source of water supply. To quote from the tests on the system as installed:

"A total of 50 mercantile blocks are protected by this service, the blocks in question containing Cleveland's largest mercantile values.

The manufacturers of the cast-iron pipe advise that its quality is the best that can be manufactured, and is made exclusively for high pressure fire service. Each length of pipe before being delivered received a test pressure of 500 lbs. to the square inch, pressure being maintained thereon from two to five minutes, and was certified to by an Inspector furnished by the City of Cleveland.

All underground piping is laid from 5½ to 9 feet below street level, and is therefore well below the frost line.



East 9th Street.

Four of the ten 150 feet hose lengths, 1⅜ inch nozzles, operating from one hydrant at once, with the "Clevelander" only in service. Pressure at hydrant 140 pounds.

All pipe before being laid was coated on the inside and outside with coal-tar and pitch varnish. All joints are leaded, and the Cleveland Water Works Department made several hydraulic tests of the leaded joints under a pressure ranging from 400 to 700 lbs., which the same withstood.

Gate valves are located in man-holes, easily accessible, at all principal cross streets.

Check valves are located in each inlet connection main from fire boats. Each hydrant connection also has a separate shut-off valve.

Ninety-six eight inch hydrants, located at an average distance of 200 feet apart. Hydrants are of Matthews Special Type, with eight inch barrel, four 3½ inch outlets with 2½ inch reducer caps, standard threads. Each outlet is controlled by an independent valve, with main valve controlling the four. Hydrants are of double frost-proof jacket type, with approved drip valves. Hydrants are set inside street curb line, and are connected to the fire main system through an eight inch branch pipe. All iron work below the ground line, and main valve rod, was coated with coal-tar and pitch varnish before being installed. All hydrants were tested at factory to a pressure of 450 lbs. to the square inch.

Direct telephonic signal service between all hydrants and Fire Boat Stations and Central Fire Exchange is installed as follows:

Open metallic circuit, 30 volt potential, supplied from storage batteries at Central Station. A station is located at each hydrant, 100 boxes in all having been purchased. System consists of 37,000 feet of No. 16 R. C. B. lead cable encased in 37,000 feet of 2½ inch iron conduit, placed underground, and divided into two circuits; one circuit of 50 stations west of Ontario Street, the other circuit east of Ontario Street, both circuits terminating at Central Fire Exchange switchboard. Two underground metallic circuits from switchboard to fire boats. Stations at hydrants are of the ordinary fire alarm box type, equipped with plugging device to which a portable telephone is attached. Fire department chiefs and companies within the boundary are supplied with portable 'phone, 12 now in service. Receiving telephone at each fire boat station.

The system is fed by water from the Cuyahoga River, delivered by the fire boats "Clevelander" and "John Farley," respectively located at foot of Superior Avenue, and foot of West 3rd Street, at each location there being a 10 inch connecting main to the underground fire main system."

These fire boats, at a test made in 1906 by the Engineers of the National Board, delivered 4335 and 3315 gallons per minute.

"The central area of the district protected (Public Square), is 79 feet above the water level, while the highest level in the district is 94 feet above the water line.

The underground pipe system is kept filled with fresh water by means of a four inch connection from the city street main system, with necessary valves. There is also a hydraulic gauge at City Hall, indicating quantity of water in the system.

First Demonstration. East 9th Street and Huron Road, at which point the grade elevation is 93 feet above water level, about the highest in the district protected, was selected, three hydrants on three different streets in the locality being used.

An alarm was sent in for special hose wagons at Engine Houses No. 1 and No. 21, which was immediately responded to.

Pressure gauges were then placed on the three hydrants in question, and ten 150 foot separate lengths of 3½ inch hose were attached to hydrant outlets, the nozzles varying in size from 1⅜ inches to 1½ inches in diameter.

Ontario Street.

Immense volume of water from ten 150 feet 3½ inch hose lengths from three hydrants; 1⅜ inch and 1½ inch nozzles. Pressure at nozzles 95 pounds, at hydrants 145 pounds, and at Fire Boats 210 pounds. The small broken stream on the left is a 150 feet 2½ inch hose length, 1½ inch nozzle from "Extra First" Fire Engine, engine working at a pressure of 200 pounds.

The Fire Chief, through new signal system, requested both fire boats connected up and put under high steam pressure.

The ten streams, six on Huron Road and four on East 9th Street, were then put into service, the highest running pressure obtained at hydrants with both fire boats in full operation and ten streams working at once being 159 pounds. The maximum pressure at the "Clevelander" registered 270 pounds, and the "Farley" 245 pounds. These streams were maintained for about forty minutes, there being no noticeable pressure fluctuations after a full head was attained.

Four of the ten streams were then shut off, leaving six operating for about twenty minutes, the running pressure at hydrants indicating a maximum of 190 pounds.

The fire boats were then worked separately under the ten streams flowing for a period of about 15 minutes each, the hydrant gauges indicating pressures running from 90 to 140 pounds, the streams later being reduced to four in number.

The vertical height and horizontal distance of the streams, together with their marked solidity, can best be determined by the photographs accompanying this report.

The apparatus was then moved to St. Clair Avenue and Ontario Street, an elevation of 74 feet above the water level, at which point was given the second demonstration.

Second Demonstration. Pressure gauges were placed on three hydrants at this locality, and ten 150 foot separate lengths of 3½ inch hose attached to hydrant outlets, the nozzles varying in size from 1⅜ inches to 1½ inches in diameter.

Both fire boats were put into service reaching a maximum pressure of 210 pounds, and the ten streams were placed in action. The maximum pressure at hydrants, with both fire boats in service and ten streams operating, registered 145 pounds. This was continued for about 20 minutes.

The fire boats were then worked separately under the ten streams flowing for a period of about 15 minutes each, the hydrant gauges indicating pressures ranging from 85 to 135 pounds, the streams later being reduced to four in number. (An unaccountable frictional loss of pressure was noticed under the fire boats operating separately during this demonstration.)

Four two inch nozzle streams were then put into service, with fire boats operating, a marked increase in the solidity and height of streams being observed.

A comparison was then made between four 150 foot lengths of 3½ inch hose streams, through two inch nozzles with both fire boats, against one 150 foot length of 2⅝ inch hose, 1½ inch nozzle, supplied by an "Extra First" Fire Engine, pressure at engine ranging from 180 to 200 pounds. The comparison in solidity and height can best be observed by photograph accompanying this report.

Three 3½ inch lines from one hydrant were tied into a three-way coupling into 3½ inch special 50 foot length with a three inch nozzle, and both fire boats placed in service, obtaining a solid stream of water at least 90 feet in height, at a running pressure of 210 pounds at hydrant, water being thrown in large quantities one block distant.

This was then repeated through a 3¼ inch nozzle, results being about the same.

The last feature exhibited was two directly connected 50 foot lengths of 3½ inch hose with 2¼ inch special type nozzles, with the "Clevelander" operating. Hydrant pressure obtained was 185 pounds."

At the close of the report the statement is made that while the present system is of great value and so far as carried out is entirely

satisfactory, the stationary pumping station should be installed for best results and it is hoped that this will be built in the near future.

The Cotton Bale as a Source of Loss by Fire.

At the Annual Meeting of our Association in May, Mr. Benjamin Richards read a paper on the Cotton Bale as a Source of Loss by Fire. This paper has attracted considerable attention and has been commented upon by papers dealing with insurance and fire loss problems. The fact that American cotton is baled in a slovenly manner making it especially liable to fire from sparks cannot be gainsaid and the need of reform is apparent. The annual fire loss due to cotton fires is enormous and the press appears to entirely agree with Mr. Richards' view that this loss would be to a large extent eliminated if cotton was properly baled as is, for instance, the cotton shipped from India and Egypt. It appears therefore important to continue the agitation of this subject with the hope that improvements in existing conditions may be gradually brought about.

The Journal of Commerce referring to a cotton fire on a steamer from Galveston, Texas, has the following to say:

"Everybody who is familiar with the American cotton bale knows in what a disgraceful way this valuable staple is packed for shipping. It is loosely compressed and so badly baled that it is exposed to waste and dirt as well as to fire on its way from producer to consumer, with the result of losses far exceeding the cost of such civilized packing as cotton from India and Egypt always receives. Speaking of the causes of the fire so frequently discovered in baled cotton, Mr. Richards said that 75 per cent. was due to sparks which these loose and ragged bales so readily catch on railroads, at stations and docks, on board steamers and from careless smokers. 'Sparks,' he said, 'are attacking the cotton from the time it is gathered until it is in the machines of the cotton mill.' And owing to the sponge-like character of the American bale a spark falling upon it may follow one of the numerous air passages which it affords and burrow into it and smoulder for days with the liability of bursting into flame in a warehouse or far out at sea. The contrast with the solidly compressed and closely bound bales of Indian or Egyptian cotton is referred to in which "inherent fires" are practically unknown. The slovenly manner in which our cotton is baled causes these immense insurance losses which must be made up in rates for insurance and causes various other losses besides.

There is every probability that this was the cause of the fire on the Boniface, the most serious part of which was not the damage to the cotton, but the danger to the vessel and all on board. It is a question whether the safety of cargoes and passengers is not a consideration that would justify prohibiting the loading of cotton in this condition upon seagoing vessels. *It is a source of danger wherever and however it is carried and it is a disgrace to American trade* wherever it is exposed to view. There ought to be enterprise and intelligence enough awakened in this trade North and South to produce reform in the baling of American cotton, for it is certain that the present slip-shod method, so far from being economical, is simply the most extravagant that could be devised on account of the immense loss and damage that it occasions."

In a later article in the same paper the Marine Underwriters are more or less held responsible for the fire losses in that they are said not to properly differentiate between cotton housed in well-constructed warehouses and cotton poorly housed or in the open.

"It is admitted that cotton when properly housed and protected has been a very

profitable class of business and there seems to be no reason why this class of cotton should not continue profitable, but the main trouble seems to be that only a very small proportion of the crop is now properly warehoused and protected. It is very probable that the question would be asked, 'Why is not the larger portion, at least, of the crop properly warehoused and protected?' The answer to this would be that no incentive has been given to the handler and shipper of cotton, and to the various railway and terminal companies to this end, and the result has been that as the crop has gone west there have been erected only the cheapest class of structures, put up with an idea to economy in the physical plant, without any regard to the protection of the staple, either from the weather or from fire, and the marine underwriters appear largely, if not wholly, responsible for this condition of affairs."

In answer to this we note Mr. Richards' reply which was published in "Fire and Fabric:"

"The point taken, that the excessive losses are primarily due to poor construction of cotton warehouses, detracts from the main question. The poor construction of buildings is a common cause of the spread of fire and, as is well known, results in excessive fire losses; but the construction of the building into which cotton bales or any other goods are stored has little to do with a fire starting. My point is that the excessive fire losses in cotton are due primarily to the poor cotton bales which provide the origin of the fire and cause it to spread rapidly, resulting in a destruction of the building, which latter is a result entirely and not a cause. The value of the contents of a cotton storehouse is always more than that of the building, and the large fire losses are due to the value of the contents rather than of the building.

I heartily agree that it is highly desirable to build well-constructed cotton storehouses with frequent fire sections, just the same as I believe in improving the construction of all classes of risks; but the fact that cotton is stored in a standard building with fire sections will not prevent the destruction of the 5,000 or so cotton bales in one of the sections. Of course, a loosely constructed building might admit the entrance of sparks, starting a fire and also aiding in its rapid spread; but my point is that under such conditions the loss on cotton would be greatly in excess of that on any other goods subject to the same conditions.

Regarding the remarks relative to the marine and other insurance companies being responsible for the fire losses, I would state that this in some respects is true, as the underwriters should generally not only distribute fire losses but should endeavor to reduce the heavy fire tax to which our country is subjected. This was my idea in pointing out the manner in which our cotton losses could be reduced. However, the fact that some skillful underwriters have succeeded in making money in insuring cotton in its present hazardous condition does not excuse those responsible for the poor cotton baling from responsibility in subjecting the consumers and handlers of cotton to a heavy fire tax."

In an article to the Insurance Herald, Mr. Ira G. Hoagland, Inspector for The South-Eastern Tariff Association, makes the point that all cotton should be compressed and properly baled at the ginnery. His remarks appear very much to the point and are given herewith.

Two Styles of Bales.

"In commenting on the paper those prominent underwriters doing so apparently disregarded the points established by Mr. Richards, and originated a counter argument bringing forth fresh considerations. The sense of Mr. Richards' arguments was to improve the American bale so that it can resist the wear and tear of transportation. This refers specifically to the compressed bale although the sense of Mr. Richards' contentions was obscured by a general reference to fires between gin

houses and cotton mills, which would indicate consideration of the uncompressed together with the compressed bale.

The cotton bale uncompressed and compressed, should be considered separately, as the difference between the respective conditions which surround them are clearly defined. This was not considered in the aforesaid paper. Any improvement in methods of compression as set forth in that paper would not have any effect on the uncompressed bales. Of course those gentlemen initially commenting on the subject, whose experience with country cotton had been good when the conditions were right, sensibly argued that improving the bale would not change conditions which now generally surround country cotton before it gets to the compress. With the present method of handling cotton, no matter what is done to improve the compressed bale, the conditions which usually attend the movement of cotton from the ginnery to the compress must be improved before the fire sacrifice can be diminished.

Conditions Crude and Wasteful.

Prior to compression cotton is in a state most susceptible to fire, i. e. in a form variously termed, country, gin or box-pressed bales. The density is low, absorption capacity great, and the covering scant and full of sample bales exposing much loose cotton. After a fire in such cotton the only salvage is from ties and buckles. Enormous quantities of cotton in this condition are moved about the South a prey to fire and it is this condition when insured by most fire insurance companies.

Whether or not country cotton is profitable under improved conditions is beside the question. The fact is beyond argument that the present method of handling cotton is both crude and wasteful all along the line. As a result of his visit abroad Mr. Harvie Jordan writes in the 'Cotton Journal' of June 27, as follows: 'One thing is certain, that unless the southern cotton growers pay more attention to the baling, marketing and delivery of their cotton in better condition on the other side of the Atlantic, the chances are that efforts to grow cotton in other countries will be pushed with even greater persistency by foreign spinners than at the present time. I know no question which should demand greater attention on the part of our cotton growers at this time than the better baling, handling and marketing of their crop.'

The solution of the problem is, insurancewise and otherwise, square bale compression at the ginnery. This would require less than half the car service to move it than as now, handling would be less—likewise the waste, the present wasteful recompression would be eliminated and cotton would reach its destination in much better shape and command a better price. The general adoption of such a plan is a matter of education and time. The adoption of this method would be a movement of great economic progress viewed from every standpoint. Not only would the bale be put in shape to resist fire from the start but the present wasteful extravagance in handling it would be eliminated.

Great Saving to Growers.

Such compression produces a square bale of considerable density, 30 pounds per cubic foot, or as much more as is desired, which density is effected and retained with 500 per cent. less pressure than is possible with the present method of compressing. The bale under this method retains its shape after leaving the press, there is no kinking or bending of staple; bales are of uniform size and weight and are easy to handle.

Compressing at the ginnery is being done at present, only in a limited way, as the compress machinery now on the market is too expensive for ginners handling only a moderate amount of cotton per season. A cheap press will doubtless be built some day which will serve to greatly extend the possibilities of this method. It is

also possible that the bale of the future will be smaller than the present one, say 250 pounds or so.

When it is realized that, after cotton has been grown, picked, ginned, baled and made ready for market, there is an additional charge of something, $1.00 per bale under present conditions which could be saved the grower, it becomes apparent that the fire waste is not alone of prime consideration. Besides reducing the fire waste by reason of the superior nature of the bale, millions of dollars per season can be saved to the growers even in Georgia. Of course, a movement like this would have many obstacles to overcome, as certain powerful interests would be against it, but the salvation of the cotton country depends upon just such an improvement and it is bound to come.

Improvements Will be Slow.

The efforts to introduce the round bale compresses several years ago were not successful because of many complicating conditions which will not obtain in the case of square bale compression at the ginnery. This radical improvement, however, will not come about immediately and much can be done to improve present conditions, which attend the bale, both uncompressed and compressed. As regards the former, better housing of cotton should obtain at compresses and railroad stations. As regards the latter, the bale as now compressed could be much improved by providing better covering and means to retain the initial density and shape of the bale.

Much is now being done in the southeastern states to improve conditions of warehousing cotton. The great compress companies have extensive building operations under way and in many towns there are being built private and co-operatively owned warehouses for cotton.

Complications Caused by Marines.

Marine underwriters, have, to say the least, seriously complicated matters by granting such unlimited coyer in their contracts at ridiculously inadequate rates which makes it well-nigh impossible to better the conditions of handling country cotton by means of increased rates. However, effort has been made to point out the right way to better these conditions despite drawbacks. The inspection and engineering department of the South-Eastern Tariff Association has issued specifications covering the construction, arrangement and fire protection of both cotton compresses and warehouses. Compliance with these specifications in the erection of new work will result in greatly improving the present method of handling cotton and in greatly reducing the fire loss.

Under the specifications of the S. E. T. A. covering compress plants without warehouse they should be located not less than 100 and preferably 200 feet from the main line of railways and should have their longest dimensions at right angles to the main line track to minimize the exposure as much as possible. Side track for loading and unloading should be "stub ends" and in no case should the locomotive be allowed to run alongside the building. The width of the building should be not less than 160 feet with such length as will provide the necessary capacity allowing 20 square feet for each bale of cotton to be handled.

Boiler Room Cut Off.

The boiler house and compress room should be located on each side of the centre of the building, with 17-inch walls parapeted three feet above the highest point in the roof. The boiler house and compress room should be joined with a 17-inch wall with all openings properly protected thus forming a complete cut-off between the two compartments of the shed. Floors should be of cement or earth and loading platforms of three inch dressed lumber. Roof lights should be of wired glass or plain glass suitably protected.

The fire protection is subject to rules and requirements for standard private extinguishing facilities with the following additional requirements: No hydrants to be located in the shed itself, but to be placed outside, at least 50 feet away from the edge of the platform, and not exceeding 200 feet apart on lengthwise sides of building. One hundred feet of "National Standard Hose" should be attached to each hydrant in standard hose house, ready for quick service. One cask of water and two fire pails to be located every 20 feet along the platform and all through the buildings, one cask of water and two fire pails for each 1,000 square feet of floor area; pails to be hung from supports nailed to post just above each barrel. Watchman to be on duty day and night, provided with approved watchman's clock. No cotton to be left outside the shed on the platform, or beyond the apron of the roof, over night, or on Sundays or holidays.

Close Cotton Warehouse.

The specifications and description of standard warehouses require each compartment limited to 1,000 bales, standing on end, one bale high, and having one or more passageways four feet wide opposite doors in end walls. In cotton-mill warehouses the capacity is limited to 600 bales.

The walls of these warehouses to meet the requirements must be at least 17 inches in thickness with three foot parapets. As in compress construction the floors must be of concrete or earth or some non-combustible material and roof lights of wired glass. Roofs of mill construction are preferred especially as when sprinkler equipments are installed less sprinklers will be required. As many doors as possible, all of standard construction, should be provided in the ends of the compartments and each compartment should be ventilated from the roof. In addition to sprinklers if such are installed casks and pails should be provided and for outside protection at least two hydrants for each compartment."

In 1902 a committee of our Association conducted some fire tests on cotton baled in various ways and a brief resume of the test may be of interest at this time. A complete report of the tests was published and distributed at that time.

OBJECTS.

"It was determined to investigate only those features of moment to the underwriters—namely, the relative merits or demerits of the various bales in the following particulars:

Extent subject and contributing to flash fires.

How affected by being subjected to a continuous fire for a given period.

How affected by immersion in water for a stated time without having previously been subjected to fire.

To what extent susceptible to fire burrowing within the bale.

TYPES OF BALES TESTED.

The four types of bales tested are here briefly described for general information.

THE "GIN BALE."

Frequently Spoken of as the "Plantation Bale" also as the "Uncompressed Bale."

It is the product of the first compression at the gin and is usually forwarded to a cotton compress for recompression, or purchased for use at no great distance from the gin. It varies greatly in size and contour, and a statement has been made that the dimensions will average about 30x40x58 inches, weighing approximately 12 pounds per cubic foot. Covered by open mesh jute bagging and bound with steel or iron bands secured by iron buckles.

THE "RECOMPRESSED BALE."

Also Known as the "Compress Bale."

This is the bale after having been reduced in size and increased in density at the compress above referred to, thus being prepared for shipment to northern mills or abroad. It is usually about 18x40x58 inches and weighs about 22 pounds per cubic foot. Covered with open mesh jute bagging and bound by steel or iron bands secured by metal buckles.

THE "LOWRY BALE."

The Planters Compress Company, proprietors. Cylindrical in form, approximate dimensions 36 inches long, 18 inches diameter, weight about 250 pounds per bale or 47 pounds per cubic foot.

This bale is made by feeding cotton through slots at top of press to the upper end surface of the bale, which is made to revolve while under pressure, bale being set on end. In the past bale has been held by four wires passing through core and around outside, but the proprietors now propose to use strap steel and buckle extending in two bands at right angles around exterior of bale lengthwise and this is the type of binding submitted for our test. After binding, a closely woven burlap bag is slipped on over bale which is tied by a drawstring, thus leaving an opening of a few inches at one end where cotton is exposed to view. There is now no opening extending lengthwise through bale but the cotton at core is less compressed than elsewhere in the bale.

THE "AMERICAN BALE."

Commonly Called the "Roundlap Bale."

The American Cotton Company, proprietors. Cylindrical in form, 35 inches long, 22 inches in diameter, weight of bale about 270 pounds, i. e., 35 pounds per cubic foot. The preceding are average dimensions and weight. Bales from Texas are apt to be slightly larger.

This bale is made by compressing a sheet of cotton between rollers and winding up the lap into a bale which is practically self-contained due to adhesion of the fibre, therefore, no ties are used. With the last revolution of the press a closely woven burlap covering is tightly wrapped about the bale until it overlaps several inches when it is sewn together and to burlap ends thus leaving no exposed cotton.

RESUME, CONCLUSIONS AND SUGGESTIONS.

Your committee is pleased to state that the various participants express themselves to the effect that the tests have been conducted in an eminently fair and impartial manner.

Our observations warrant grading the subjects of investigation in the following relative positions:

ORDER OF EXCELLENCE.

TEST.	AMERICAN.	LOWRY.	DRY GOODS.	RECOMPRESSED.	GIN.
Flash	1	2	3	4	5
Burrowing	2	1	..	3	4
Fire	1	4	5	2	3
Immersion	2	1	..	3	4

FLASH TEST.

One result stands out clearly above all others as of prime importance to fire underwriters. It is shown that *the American and Lowry bales are not subject to flash fires.* In this test the fire flashed immediately over the square bales, but did not spread at all on the cylindrical bales.

There seems to be but little gained by using the special covering treated with the fire retardent.

Baled dry goods that are not completely covered with burlap are more easily set on fire than American or Lowry baled cotton.

Statistics based upon the ordinary square bale while on storage and in shipment show a large majority of cotton fires to be caused from sparks, matches, and smouldering tobacco igniting the loose cotton found exposed and protruding from the square bale. These tests show that with the cylindrical (American and Lowry) bales such fires would be largely eliminated.

Experience with cotton fires shows that flames flash with incredible rapidity over the exterior surface of adjoining ordinary square bales. The almost instantaneous spread of such fires has frequently resulted in loss of life as well as of property, and extended the flames beyond available means of extinguishment. The cylindrical bales also eliminate this most undesirable feature. Therefore, their introduction in lieu of the present commercial square bale could be confidently expected to largely reduce the number of fires, and, where fire did occur, to occasion a less rapid spread of flames, a slower combustion, and hence much greater chance of extinguishment and salvage.

This superiority is due to the use of a closely woven and snug fitting burlap covering on the cylindrical bales. This covering and the cotton on the outer surface of the bale do not burn freely in the early stages of a fire, as, due to the close fit, there is a limited amount of air, necessary to support combustion, admitted between the two. On the other hand, the ordinary square bale with its open mesh jute bagging allows the less closely compressed cotton to protrude through the meshes, thus inviting fire.

As between American and Lowry bales, the latter is more exposed to sparks because of the open end, and, once ignited, burns somewhat more freely in the first stages of a fire, due to the covering not being as closely applied to the cotton.

The large size and weight of the square bale necessitates the free use of hooks and tackle in shipping, and, furthermore, it is "screwed in" and "broken out" of ships' holds, which, aside from sampling, subjects the bagging to rough usage with the inevitable result that it becomes torn in several places on the average bale, thus allowing the cotton to be exposed in large patches, sometimes comprising the entire side or end of a bale.

Due to its small weight and form, making it easy to roll about, the cylindrical bale suffers little in transit, and even the burlap covering remains substantially intact, not of necessity being subject to the use of hooks. Again, if the covering becomes torn, due to its close adhesion to the cotton and the greater density of the latter, there is little inclination for the cotton to protrude through the rent.

Sampling of the ordinary square bale is generally practised and results in exposing the cotton to a greater than normal extent at one or more points. The American bale can be sampled by ripping the stitches of the covering at one of the seams; the Lowry bale at either end of the bag.

The square bales can be piled more closely together than the cylindrical, which is a point in favor of the former. It would seem to us desirable to suggest that the Lowry bale be entirely covered with burlap, and that the square bale interests might to advantage consider the advisability and feasibility of putting up cotton in a smaller bale much more easily handled without injury to the covering, and then using a closely woven burlap covering, so compressing the bale, applying the cover and the ties that the latter will not tear the burlap and that the burlap will lie closely against the cotton at all sides of the bale.

FIRE TEST.

Much judgment must be exercised in making deductions from this particular

test and applying them to cotton fire hazards. The conditions of test are not likely to be the same as those found in practice, the latter varying from slight scorching to complete combustion. In this test the cotton was placed upon a grid and broiled, as it were, over a wood fire for one hour. At a platform, pier, or warehouse, at least a portion of the cotton is to be found resting on a solid floor. Many fires will be found much less severe, while, on the other hand, others are of greater intensity and longer duration. It can be seen from the tests that, had the fire not brought about a high enough temperature or continued long enough to cause the bursting of the bands on the Lowry bales, the salvage results for this bale would have been altogether better. Had the fire continued for a longer period and attained sufficient heat to cause the bursting of the ties on the recompressed and gin bales as occurs occasionally in actual warehouse fires, the salvage results would have been less satisfactory on these two types of bales. Ties are used on a bale to restrain compressed cotton, and, when they break, the cotton naturally opens up and is thus much more susceptible to quick burning. In this connection, it is noted that the American bale has no ties and is self-contained, due to the adhesion of the cotton fibres forming the continuous lap, which because of the method of compression, contains no force to expand the bale.

The Lowry bale is noticeable in this test as rendering comparatively small salvage after a severe fire, due to expansion of the bale, bursting of ties, and opening up of the cotton to the flames throughout the entire length of the bale. This is occasioned by the method of forming the bale, whereby we would liken the cotton restrained by the ties to a spiral spring held under compression.

It has been suggested that this expansion might be the means of injuring walls or floors in event of fire in a closely packed wareroom containing this type of bale.

To the proprietors is suggested the consideration of some means of overcoming this defect.

Particular attention is called to the nearly total damage to the bale of dry goods by the flames flashing over one side and scorching the edge of each fold of cloth. This ruin was completed during the first few minutes of fire test. Yet no appreciable monetary damage was done any of the cotton bales by the flash test. Therefore, with the flash hazard removed, as with the cylindrical bales, the cotton presents a better "fire risk" than the dry goods in bales.

The wire ties on one of the gin bales demonstrated weakness as against the strap ties on a similar bale.

BURROWING TEST.

It has been commonly observed that fires are inclined to eat their way into the interior of the ordinary square bale, pursuing irregular courses as determined by paths of least resistance. These tests were not extensive enough to determine the comparative susceptibility of the several types to burrowing fires, as the fire in each case, although slow, spread much more rapidly on the outside of the bales. However, it developed that, due to greater density, the cylindrical bales would in numerous instances resist ignition and not support a fire as from sparks or brands, while the square bale in each case was destroyed upon the first test. The Lowry bale successfully resisted repeated applications of a hot bolt head to the *side* of the bale, but was destroyed upon application at the *end*. Precisely the reverse was true of the American bale, which was easily fired from the *side* but with difficulty from the *end*. It may be concluded, therefore, that so far as this single feature is concerned, it would be well to store American bales on end, Lowry bales on side. This red hot bolt head constitutes a much more severe trial than that ordinarily furnished by sparks and cigar butts.

These tests, as they developed, serve rather to supplement the flash and burning tests than to bring out facts relating to fire eating its way through or burning out the interior of bales.

We are not able with the information at hand, to pass upon the claims frequently made for cylindrical bales, that, due to the extreme pressure and mechanical means employed in putting up the bale, there is no possibility of sparks, unignited matches, etc., being compressed within the bale, as has been done when recompressing the square bale, or in other words, putting up a bale with fire buried within, which in time, perhaps many days afterwards, may burrow outward and be the means of a more serious conflagration. It is, however, self-evident from the methods of preparing these cylindrical bales that there is less likelihood of foreign matters, particularly of any size, being put up in the bale, and that the considerable exclusion of air accomplished in the process would have a tendency to smother combustion in the interior of such bales.

IMMERSION TESTS.

Results in this test are derived from holding the bales entirely submerged beneath the surface of water, as frequently occurs in practice, but yet are not the same as when the bales are thrown overboard and allowed to float, when they are only partially submerged and a much longer time would be required for them to become sufficiently saturated to sink. On the other hand, had the submersion been continued longer, the expansion might have been sufficient to burst the ties.

The following conditions obtained immediately upon removal of cotton from the vats:

48-HOUR IMMERSION TEST.

TYPE.	DRY WEIGHT.	WET WEIGHT.	WATER ABSORBED.
Lowry	260 Pounds.	312 Pounds.	20 Per Cent.
American	270 "	366 "	35 "
Recompressed .	360 "	1468+ "	162+ "
Gin	507 "	1558+ "	207+ "

SUMMARY.

In final summarization, your Committee would report that it finds the cylindrical bales to be distinctly superior to the square bales as fire risks, and in turn, the American bale superior to the Lowry, the recompressed to the gin bale, and both cylindrical bales to the dry goods."

IN MEMORIAM.

One of our associate members, Mr. A. R. Williams, Superintendent of the Special Risk Department of the New York Underwriters Agency, died of pneumonia in Toronto, September 2, 1907. Mr. Williams was actively indentified with "improved risk" underwriting and had a large experience in fire protection work. The Underwriters' Bureau of the Middle and Southern States passed the following resolution:

"RESOLVED: We keenly realize that the death of Alonzo R. Williams has deprived us of a comrade whose experience and judgment were of a high order and whose energy, enthusiasm and devotion to his work were exceptional. Mr. Williams possessed in a marked degree the qualities that make for success, and both the profession and the corporation which he served will greatly miss him. The recollection of his cheery disposition and genial personality causes a deep feeling of personal loss and we warmly sympathize with his bereaved family and friends."

Progress Reports from Committees.

EXECUTIVE COMMITTEE.

LIST OF MEMBERS ELECTED BY THE EXECUTIVE COMMITTEE SINCE LAST JUNE.

JULY, 1907.

ACTIVE.

West Virginia Inspection Bureau, Kanawha Valley Bank Building, Wheeling, West Virginia.

ASSOCIATE.

Mr. William R. Barton, St. Louis Fire Prevention Bureau, 734-41 Pierce Building, St. Louis, Mo.

Mr. Benj. G. Buttolph, Vice President and Engineer, Manufacturers Mutual Fire Insurance Company, 815 Banigan Building, Providence, R. I.

Mr. Albert B. Clower, Special Agent, Hartford Fire Insurance Company, 818 Gravier Street, New Orleans, La.

Mr. Robt. P. Clower, Special Agent, Royal Insurance Company, 1008 Hennen Building, New Orleans, La.

Mr. F. E. Fowler, Insurance, 1253 Pierce Building, St. Louis, Mo.

Mr. R. E. Hartshorn, Inspector, Factory Insurance Association, Berlin, Mass.

Mr. Frank B. Heller, with Louis Schlesingh, Union Building, Newark, N. J.

Mr. Leon Irwin, Leon Irwin & Company, 838 Gravier Street, New Orleans, La.

Mr. Albert L. Kendall, Inspector, Associated Factory Mutual Fire Insurance Companies, Room 510, 31 Milk Street, Boston, Mass.

Mr. E. Arthur Lohmeyer, Inspector, Home Insurance Company, Home Insurance Company Building, South and Water Streets, Baltimore, Maryland.

Mr. P. W. Raymond, Surveyor, Factory Insurance Association, 186 Vine Street, Hartford, Conn.

Mr. F. C. H. Robins, Special Agent, American Insurance Company of Newark, 300 Union Trust Building, Los Angeles, Cal.

Mr. Louis C. Shaul, Inspector, Middle States Inspection Bureau, 58 William Street, New York, N. Y.

Mr. Geo. B. Smith, Manager, Australian Alliance Assurance Company, 31 O'Connell Street, Sydney.

SUBSCRIBING.

Mr. W. G. Cowles, Secretary, Liability Department, Travelers Insurance Company, P. O. Box 1056, Hartford, Conn.

Mr. Geo. E. Fingerhuth, 108 Menominee Street, Chicago, Ill.

Mr. J. H. Frederickson, with James Stewart & Company, Contractors, 311 Hibernia Bank Building, New Orleans, La.

Mr. George J. Glover, General Contractor, 1111 Hibernia Bank Building, New Orleans, La.
Thomas Magee & Sons, 22 Geary Street, San Francisco, Cal.
Manhattan Fire-proof Door Company, 412 to 422 East 125th Street, New York, N. Y.
Mr. Frank Mesker, Mesker & Bro., 421 South Fifth Street, St. Louis, Mo.
O'Neil Engineering Company, Dallas, Texas.
Mr. Frank L. Stephens, Automatic Sprinkler Construction Company, 159 La Salle Street, Chicago, Ill.
Mr. Percy R. Stuart, Coast Manager, Roebling Construction Company, 1017-1018 Crocker Building, San Francisco, Cal.
Mr. C. T. Whipple, Manager, Glens Falls Lantern Company, Glens Falls, New York.

AUGUST, 1907.

ASSOCIATE.

Mr. Louis Belfield, Inspector, Middle States Inspection Bureau, 58 William Street, New York, N. Y.
Mr. Stanley Besse, Factory Insurance Association, 10 Garden Street, Newburyport, Mass.
Mr. G. H. Bigelow, Inspector, Factory Insurance Association, Waterbury, Conn.
Mr. T. H. Buxton, Inspector, Factory Insurance Association, 624 North College Street, Charlotte, N. C.
Mr. Charles W. Cutting, Special Agent, Insurance Company of North America, 248 Fourth Avenue, Pittsburg, Pa.
Mr. Dixwell Davenport, Manager, Insurance Department, care of The Fred B. Grinnell Company, Spokane, Washington.
Mr. Archibald B. Diggins, Special Agent and Adjuster, The London Assurance Corporation, Springfield, Mo.
Mr. John E. Downey, Inspector, Factory Insurance Association, 44 Washington Park, Newtonville, Mass.
Mr. Welsey P. England, Special Agent, care of Clarke & Cortis, 100 William Street, New York, N. Y.
Mr. H. C. Harris, Electrical Inspector, Ohio Inspection Bureau, Columbus, Ohio.
Mr. H. E. Harvey, Factory Insurance Association, 39 Waconah Street, Pittsfield, Mass.
Mr. J. P. Hitchcock, with F. L. Hitchcock & Son, Fire Insurance, 507-09 Commonwealth Building, Scranton, Pa.
Mr. W. F. Holden, Spring Garden Insurance Company, 613 Massachusetts Building, Kansas City, Mo.
Mr. C. W. Johnson, Inspector, Factory Insurance Association, P. O. Box 157, West Hartford, Conn.
Mr. Edw. H. Keith, Inspector, Underwriters Bureau of the Middle and Southern States, 71 William Street, New York, N. Y.
Mr. P. H. Knighton, State Agent, German American Insurance Company, 221 North 4th Street, Hannibal, Mo.

Mr. G. Y. Lancaster, Jr., Inspector, Factory Insurance Association, 17 Forbes Street, Worcester, Mass.
Mr. Chas. Macomber, Jr., Inspector, Factory Insurance Association, 44 Cottage Street, Fall River, Mass.
Mr. J. E. Malone, Factory Insurance Association, 83 Palmer Street, Fall River, Mass.
Mr. F. H. Metcalf, Engineer, New England Bureau of United Inspection, 36 Cass Street, Melrose, Mass.
Mr. F. H. Naedele, Inspector, Factory Insurance Association, 330 Windsor Avenue, Hartford, Conn.
Mr. Edward L. Nye, Special Agent, Farmers' Fire Insurance Company, 3070 Waverly Avenue, Syracuse, N. Y.
Mr. C. A. Robinson, Factory Insurance Association, 25 Hudson Street, Hartford, Conn.
Mr. Chas. F. Thayer, Inspector, Factory Insurance Association, Holden, Mass.

SUBSCRIBING.

Bureau for the Safe Transportation of Explosives and other Dangerous Articles, Room 11, 24 Park Place, New York, N. Y.
Burnett, Ormsby & Clapp, Limited, Insurance Brokers, Toronto, Ontario.
Mr. James E. McWilliam, care of J. E. McWilliam & Sons, Worcester County, Hubbardston, Mass.
Mr. T. M. Purtell, State Fire Marshal, Madison, Wis.
Mr. W. W. Young, Consulting Engineer, 220 Broadway, White Plains, New York.

SUBCOMMITTEE ON DENATURED ALCOHOL.

Early in August the Subcommittee on Denatured Alcohol held a meeting in New York at which all of the members were present, namely, A. H. Nuckolls, J. Albert Robinson, W. D. Grier and H. A. Fiske. The forenoon was spent by the committee in going over the papers which have been published in the Bulletins and Quarterly and discussing the hazards involved. In the afternoon the Representatives of the Committee of Manufacturers were invited to be present and the following gentlemen were present: J. H. Allen, Secretary of the Committee, Whidden Graham, Thomas L. White, V. C. Vanicek, Urbain J. Ledoux, the latter being Ex-American Consul at Prague, Austria.

The experience of foreign countries with denatured alcohol was outlined, particularly France and Germany, where it is used in large quantities. From statements made by the Committee of Manufacturers it would appear that in the countries mentioned there were no restrictions regarding its use or storage other than would apply to ordinary grain alcohol and that in Germany, where considerable attention is paid to the handling of combustibles or volatile liquids, it was considered no more hazardous than kerosene oil. It further appeared that in Germany it was very extensively used for heating, lighting and cooking and they cited the experience in that country as showing that there was no serious hazard involved. It is to be noted however that in Germany they only use 2% of wood alcohol as

against 10% here. This question of the fire record of other countries using denatured alcohol will be further investigated by the committee.

It was stated that the following formula was being used for the general trade:

Ethyl Alcohol	100 gallons.
Methyl Alcohol	10 gallons.
Benzine (Low Grade Kerosene)	½ gallon.

And while the other government formula which substitutes pyridine bases for the crude kerosene is allowed there are several reasons which will make its used very limited. Numerous special formulas are being allowed by the government for use in certain specified manufacturing processes and these consist generally of ordinary (ethyl) alcohol and a certain amount of wood alcohol, the low grade kerosene or pyridine bases being eliminated. It appears that in some cases a small percentage of ether has been used as a denaturant and in such instances the hazard may be increased, this feature needing further investigation.

In determining on a denaturant the government desired a compound which could not easily be separated from the alcohol by distillation or other means and it appears to be true that in wood alcohol we have a denaturant which fills these qualifications. If the wood alcohol evaporated freely when mixed with ethyl alcohol it would not serve its purpose and tests made by Mr. Nuckolls show that the flash point of denatured alcohol is comparatively little less than that of ethyl alcohol.

Without making any formal report at this time the meeting seemed to develop the following points. The low grade kerosene required in the government formula may be ignored in that it is no more hazardous than the wood alcohol which latter constitutes the chief denaturant so far as percentages are concerned. The hazard of denatured alcohol must be classed somewhere between ordinary alcohol and wood alcohol, and flash point tests, while indicating only one phase of the hazard, tend to show that denatured alcohol is nearer ordinary alcohol than the more volatile wood alcohol. The Committee hopes to make additional tests in order to, if possible, more definitely fix the hazard in comparison with the two types of alcohol. If, as it now appears, denatured alcohol is at least somewhat safer to use than wood alcohol it would not seem necessary to advocate more stringent regulations than for the latter. Furthermore when we consider that denatured alcohol will not only replace wood alcohol in many cases but also may replace more hazardous compounds, such as benzine and gasolene, it appears that its general introduction, under proper restrictions, should tend to reduce the fire loss rather than increase it.

HENRY A. FISKE, *Chairman.*

COMMITTEE ON FIRE-PROOF CONSTRUCTION.

The plan for tabulation of fire-proof building fires, as suggested in the last issue of the Quarterly by the Committee on Fire-proof Construction, is now under way, and members are being furnished

with special blanks for this purpose, a copy of which is reproduced herewith.

It is the hope of the Committee that not only members of the National Fire Protection Association but others interested in the subject of fire-proof construction will make free use of these blanks, and send to the Committee as full details as are obtainable of any fires, great or small, in any building claiming fire-proof classification, so that the Committee may be in a position to more intelligently report to the Association on the subject, and also to publish in this bulletin accounts of fires which would be of interest to its readers.

The blank is designed to call for as much data as is consistent with a brief report readily filled in by any one, whether specially expert in the matter of construction or not, and it is expected that in many cases further correspondence will be required to develop features not anticipated in the blank.

It should also be borne in mind that fires which might seem unimportant and involve only a trifling financial loss should be carefully reported, especially where it is evident that the particular construction or arrangement of the building, or any part of it, was the factor which prevented the fire from becoming as serious a loss as it might have if started under the same conditions in a building of ordinary construction.

The subject is of growing interest and importance, and should have the most careful attention of all members.

E. T. CAIRNS, *Chairman.*

The following questions appear on the Fire-Proof Report Blank:

Name of Risk?
Location?
Date of fire? Time of day. A. M. P. M.
Occupancy of building with special reference to portions effected by fire?
Age? Height? Area?
How was fire discovered and alarm how given?
Cause of fire (in detail)?
With what was fire fought and how extinguished—(duration of fire)?
General type or system of construction (If concrete give full details of mixture and reinforcement including insulation of metal members)?
Insulation of columns, girders and beams (material, thickness and method of securing)?
Type of floor and roof arches (hard or porous tile, thickness, span flat or segmental)?
Wood flooring? Cinder filled?
Roof covering?
Finish of outside walls?
Window protection (kind of shutters or wired glass)?
Fire-proof partitions (construction, location)?
Character of interior finish or decoration.
Stairs, elevators or other vertical openings, how protected?
Spread of fire and damage to contents?
General Remarks. Details of damage to structural parts, fire-proofing, interior and exterior finish and other points of interest brought out by this fire?

Address The Editor, P. O. Box 1284, Hartford, Conn., for copies of the Fire-Proof Report Blank.

Tobacco Factories.---Fire Record.

Total Number of Fires, 34.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, none.
HEATING. Number of fires, 1.
Defective chimney.
POWER. Number of fires, 1.
500-volt power circuit ignited ceiling and floor above.
BOILER (or fuel). Number of fires, 1.
Boiler breeching ignited dust that had collected on same.
RUBBISH (or sweepings). Number of fires, none.
OILY MATERIAL. Number of fires, 2.
Roll of newly painted signs awaiting shipment ignited spontaneously.
Workman's clothes saturated with linseed oil ignited spontaneously.
SMOKING. Number of fires, 2.
Lighted cigar in waste-paper basket.
Cigarette butt.
LIGHTNING. Number of fires, 1.
MISCELLANEOUS. Number of fires, none.

Special Hazards.

WASTE MATERIAL. Number of fires, 1.
Probably spontaneous combustion in pile of dried tobacco stems.
DRY-ROOM. Number of fires, 2.
Originated in dry-room.
Foreign material in scrap tobacco in dry-room.
MACHINE DRYER. Number of fires, 1.
Started in tobacco machine dryer.
"HOG" OR SCRAP WOOD BREAKER. Number of fires, 2.
Hard substance in hard wood breaker caused spark igniting scrap wood and dust in frame chute above machine.
Originated in a wood chute at kindling chopper in box factory.

Summary.

Common Causes.

	Number of Fires.	Per Cent. of Whole.
Lighting,	0	
Heating,	1	7.1
Power,	1	7.1
Boiler (or fuel),	1	7.1
Rubbish (or sweepings),	0	
Oily Material,	2	14.3
Smoking,	2	14.3
Lightning,	1	7.1
Miscellaneous,	0	
Total,	8	

Special Hazards.

Waste Material,	1	7.1
Dry-Room,	2	14.3
Machine Dryer,	1	7.1
"Hog" or Scrap Wood Breaker,	2	14.3
Total,	6	
Common Causes,	8	57
Special Hazards,	6	43
Total,	14	
Incendiary,	4	
Exposure,	0	
Cause Unknown Fires,	16	
Total Tobacco Fires,	34	

2. DETAIL OF CAUSES.

Common Causes.

H-330. Fire probably caused by 500-volt power circuit. Started on ceiling immediately over wires, probably due to ground or short circuit. Wires protected by obsolete porcelain base open-link fuse.

S-3343. Fire occurred in workman's overalls and jumper which were partly saturated with linseed oil. Metal clothes-closets should be used and everything of this nature kept therein.

Special Hazards.

S-5540. Fire occurred in scrap wood breaker often called a "Hog." Friction of some hard substance in the scrap wood breaker ignited the scrap wood and dust in the frame chute above machine.

3. ROOMS IN WHICH FIRE OCCURRED.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Non-Manufacturing Portions, (including storage),	..	..	2	33	6	43	8	32
Advertising Department,	..	..	1	17	..	..	1	4
Boiler-Room,	..	..	1	17	..	..	1	4
Box-making,	2	40	1	17	..	..	3	12
Cigar-making,	..	..	..	..	1	7	1	4
Cigarette-making,	..	..	1	17	1	7	2	8
Drying Room,	3	60	..	..	2	14	5	20
Packing	..	..	..	..	1	7	1	4
Plug Department,	..	..	..	..	1	7	1	4
Prizing Room,	..	..	..	..	1	7	1	4
Stemming Room,	..	..	..	..	1	7	1	4
Total with data given,	5		6		14		25	
No data,	1		2		6		9	
Total,	6		8		20		34	

4. DAY OR NIGHT. (Day Fires, 6 a. m. to 6 p. m.)

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Day,	4	67	2	33	3	17	9	30
Night,	2	33	4	67	15	83	21	70
Total with data given,	6		6		18		30	
No data,	..		2		2		4	
Total,	6		8		20		34	

5. PLANT IN OPERATION.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Plant in operation,	4	67	..	..	1	6	5	19
Plant not in operation,	2	33	3	100	16	94	21	81
Total with data given,	6		3		17		26	
No data,	..		5		3		8	
Total,	6		8		20		34	

6. HOW DISCOVERED.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Employee, ...	3	50	2	28	2	10	7	21
Watchman, ...	..	..	1	14	6	30	7	21
Thermostat, ...	..	..	..	..	..	..	..	..
Sprinkler alarm, .	2	33	2	28	1	5	5	15
Outsider, ...	1	17	2	28	11	55	14	42
Total with data given, ...	6		7		20		33	
No data, ...	..		1		..		1	
Total, ...	6		8		20		34	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	Number of Fires.	Per Cent. of Whole.
Extinguished or practically extinguished fire, ..	11	79
Held fire in check, ...	3	21
Unsatisfactory, ...	..	..
Total, ...	14	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES. (None.)

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where the sprinkler control is satisfactory). None.

10. POINTS OF INTEREST FROM SPRINKLER FIRE REPORTS.

Concealed Spaces.

S-5983. Fire was found to be in a hollow four-inch wall in passageway where sprinklers could not extinguish it.

Construction.

H-742. Heavy water damage shows that all floors should be scuppered. Outside iron fire-escape greatly aided firemen.

Unsprinklered Portions.

S-3680. Fire started in an unsprinklered closet and gained considerable headway. It was not discovered until watchman noticed water pouring through ceiling.

11. NUMBER OF SPRINKLERS OPENED.

No of Sprinklers Operating.	Satisfactory Fire. No. of fires.	Satisfactory Fire. Per cent.	Held Fire in Check. No. of fires.	Held Fire in Check. Per cent.	Unsatisfactory. No. of fires.	Unsatisfactory. Per cent.	Total. No. of fires.	Total. Per cent.
1	8	73	1	33	..	..	9	64
2	1	9	..	..	..	..	1	7
3	..	..	1	33	..	..	1	7
4	1	9	..	..	..	..	1	7
5	1	9	..	..	..	..	1	7
6 to 9 inc. ..	..	..	..	..	..	..	..	..
10 to 24 inc. ..	..	..	1	33	..	..	1	7
25 to 49 inc. ..	..	..	..	..	..	..	..	..
50 and over ..	..	..	..	..	..	..	..	..
Total ...	11		3				14	

No. of Sprinklers Operating.	No. of fires.	Per cent. of whole
1	9	64
2 or less ...	10	71
3 or less ...	11	79
4 or less ...	12	86
5 or less ...	13	93
Less than 10	13	93
Less than 25	14	100
Less than 50	..	..
50 and over	..	..

Average number of sprinklers opened not including unsatisfactory, 2.8.

12. ALARM SERVICE.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman, ...	3	100	..	..	3
Thermostats, ...	..	..	..	..	..
Sprinkler Alarm, ...	2	100	..	..	2

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Total.
Watchman and Sprinkler Alarm, ...	3	1*	4	..	..	..	4
Watchman and Thermostats, ...	..	..	..	..	..	..	..
Sprinkler Alarm and Thermostats, ...	..	..	..	..	..	..	..
Watchman, Sprinkler Alarm and Thermostats, ...	..	1*	1	..	..	1	1

*These include fires where sprinker alarm or thermostats notified the watchman.

NOTE. These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

Points of Interest from Fire Reports as Regards Alarm Service.

588. Fire was discovered by member of fire department shortly after watchman had made his regular round.

1477. Fire was not discovered until it was under considerable headway. It occurred at night and there was no watchman.

2431. Thermostats failed to operate. Sprinklers operated first. Thermostats were about fifteen feet from fire.

3680. Considerable water damage owing to delay in discovering fire. There should have been a sprinkler alarm.

Department Stores.---Fire Record.

Total Number of Fires, 122.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 22.

Lighted candle left burning in wooden holder.
Watchman placed lantern inside of wooden locker without extinguishing same.
Ignition of oil and dust in metal flue by torch.
Explosion of coal-oil lamp left burning after lighting current was cut off.
Machinist using hand torch while repairing elevator apparatus ignited oily material.
Sweeper moved an iron bed containing draperies against a lighted gas jet.
Man lighting gas ignited curtains.
Defective decorative electric light bulb ignited trimmings.
Cheese cloth trimmings caught fire from heat of electric light bulb.
Stock draped around incandescent lamp confined the heat igniting same.
Incandescent lamp ignited woodwork.
Short circuit of live feed wires.
Flexible electric light cord thrown over steam-pipe, insulation burned off and short circuited.
Temporary electric light wires in tile shaft became crossed and ignited insulation.
Crossed electric light wires in an exhibit tower.
Spark from electric sign flasher ignited insulation and frame folding machine.
Defective electric illuminated sign apparatus.
Defective insulation on enclosed arc lamp.
Short circuit on electric light wiring.
Defective electric light wiring, 3 fires.

HEATING. Number of fires, 2.

Heat from stove ignited floor.
Overheated uptake ignited wood joists.

POWER. Number of fires, 2.

Motor burned out, used for elevator.
Burning out of armature of motor.

BOILER (or fuel). Number of fires, 2.

Spark from boilers ignited woodwork.
Overheated boiler ignited loose boards on top of same.

RUBBISH (or sweepings). Number of fires, 19.

Spontaneous combustion of rubbish and sweepings, 13 fires.
Spontaneous combustion of waste material in wooden box.
Combustion in pile of waste paper.

Occurred in waste paper and sweepings.
Rubbish dumped too near front of boilers.
Match in truck load of rubbish.
Waste material in box in dressmaking room.

OILY MATERIAL. Number of fires, 4.
Spontaneous combustion of oily waste, 3 fires.
Spontaneous combustion of greasy papers.

SMOKING. Number of fires, 2.
Window dressers were smoking.
Cigar stub carelessly thrown down in wooden vestibule at main entrance.

LIGHTNING. Number of fires, none.

MISCELLANEOUS. Number of fires, 8.
Workman heating pail of cable grease over gasolene torch, grease boiled over.
Caused by burning refuse in open salamander in rear of store.
Carelessness of employee with lighted match.
Employee lighted paper to expand bearing on fan shaft.
Employee thawing out frozen pipe with gasolene furnace ignited combustible material.
Match carelessly thrown onto some blankets and comforters.
Telephone wires crossed with high tension, 2 fires.

Special Hazards.

BRONZING. Number of fires, 1.
Boy bronzing picture frame with an inflammable mixture of bronze.

FINISHING RAGS. Number of fires, 1.
Ignition of waste saturated with furniture polish lying on steam-pipes.

CANDY STOVE. Number of fires, 1.
Pot of candy on gas stove boiled over.

KITCHEN STOVES. Number of fires, 4.
Soot in blower (ventilating system) over kitchen range ignited.
Hot grease on range, 2 fires.
Pot of grease either boiled or tipped over on hot range.

PAPER PICKER. Number of fires, 1.
Friction in waste paper picker.

SAD IRONS. Number of fires, 1.
Caused by electric sad iron being left with current turned on.

WASTE CHUTE. Number of fires, 11.
Spontaneous combustion in waste chute, 7 fires.
Employee dropped match or cigar in waste chute.
Unknown in waste chute, 3 fires.

Summary.

Common Causes.

		Number of Fires.	Per Cent. of Whole.
Lighting		22	27.2
Electric	15		
Gas	2		
Kerosene	2		
Torch	2		
Candle	1		
Heating		2	2.5
Power		2	2.5
Boiler (or fuel)		2	2.5
Rubbish (or sweepings)		19	23.5
Oily Material		4	4.9
Smoking		2	2.5
Lightning		0	
Miscellaneous		8	9.8
Total		61	

Special Hazards.

Bronzing		1	1.2
Finishing Rags		1	1.2
Candy Stoves		1	1.2
Kitchen Stoves		4	4.9
Paper Picker		1	1.2
Sad Irons		1	1.2
Waste Chute		11	13.6
Total		20	
Common Causes		61	75
Special Hazards		20	25
Total		81	
Incendiary		1	
Exposures		11	
Cause Unknown Fires		29	
Total Department Store Fires		122	

2. DETAIL OF CAUSES.

Common Causes.

S-570. Cheese cloth trimmings caught fire from heat of electric light bulb.

S-1264. Millinery trimmings draped around incandescent light were ignited.

S-2639. Assured placed building paper on ceiling in boiler room

to prevent dust from rising through floor. This paper was ignited by heat from boiler.

S-4410. The cause of fire was occasioned by the accidental crossing of a telephone wire leading into the building, with a trolley wire at the corner of Third Avenue and Seventh Street, about eleven blocks distant, at which point the telephone wires cross the street over the trolley wires. The telephone wire in breaking fell across the trolley wire and a current of 500 volts pressure was carried into the building over the telephone wire. There were no fuses on the line at entrance.

The whole trouble can be attributed to absence of line fuses and the lack of proper separation and supporting of wires up to the point where the protective devices were located.

S-5596. Flexible electric light cord thrown over steam-pipes. Insulation burned off and short circuit occurred.

S-5601. Short circuit in arc lamp set fire to insulation and broke the globe; hot particles dropped on clothing setting fire to same. The fuse controlling this lamp was found to be defective.

S-6155. Fire was probably caused by watchman's lantern being placed in a wooden locker and not extinguished.

Special Hazards.

H-810. Fire occurred on roof in frame enclosure used as a fan room to exhaust air and heat from kitchen. There is a large blower pipe from kitchen to roof and it is thought that the soot in same became ignited.

S-3430. Fire started in waste paper vault in sub-basement and sparks or burning bits of paper from same rose to top of waste chute on ninth floor and rested in blind attic. Chute is about ten feet long and three feet wide, both ends and one side of same are of brick and the remaining side terra-cotta. This terra-cotta partition extends merely through ceiling sheathing under blind attic and not to roof, so that top of chute communicated freely with the blind attic.

Fire in blind attic was discovered by a watchman on the top floor and smoke was discovered by a sweeper on the third or fourth floor at about the same time. The alarm was immediately spread and the engineer started fire pump, maintaining 120 lbs. pressure. One sprinkler at top of chute opened wetting down the sides and throwing water into the blind attic through the same openings by which the fire had spread and extinguished burning material here; one sprinkler also opening on the fourth floor and two in the vault. Watchman, sweepers, etc., led out the hose from standpipes and used hand chemicals, totally extinguishing the fire. A thermostat in the vault also operated calling the fire department but their services were not required.

3. ROOMS IN WHICH FIRE OCCURRED.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Basement,	..	..	6	11	2	7	8	8
Boiler Room,	..	..	6	11	1	3	7	7
Candy Kitchen,	1	5	1	2	..	..	2	2
Carpet Department,	..	..	..	..	1	3	1	1
Dressmaking Department,	..	..	1	2	..	..	1	1
Drug Department,	..	..	1	2	..	..	1	1
Drapery and Curtain Dept.,	..	..	2	4	..	..	2	2
Elevator Well and Pit,	..	..	5	9	2	7	7	7
Electric Wire Shaft,	..	..	1	2	..	..	1	1
Engine-Room,	..	..	2	4	..	..	2	2
Furniture Department,	1	5	2	4	..	..	3	3
General Sales Room,	..	..	4	7	3	10	7	7
Grocery Department,	..	..	..	..	1	3	1	1
Kitchen of Restaurant,	4	20	1	2	..	..	5	5
Light Well,	..	..	..	..	1	3	1	1
Millinery Department,	..	..	1	2	..	..	1	1
Rubbish and Waste Paper Storage,	1	5	5	9	4	13	10	9
Shipping and Packing Room,	1	5	2	4	2	7	5	5
Show Windows,	..	..	9	16	3	10	12	11
Storage and Stock Rooms,	1	5	5	9	10	33	16	15
Upholstering Department,	1	5	..	..	..	..	1	1
Vestibule,	..	..	1	2	..	..	1	1
Waste Chute,	10	50	..	..	..	..	10	9
Total with data given,	20		55		30		105	
No data,	..		6		11		17	
Total,	20		61		41		122	

4. DAY OR NIGHT. (Day Fires 6 a. m. to 6 p. m.)

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Day, ...	13	65	23	39	17	45	53	45
Night, ...	7	35	36	61	21	55	64	55
Total with data given, ...	20		59		38		117	
No data, ...	..		2		3		5	
Total, ...	20		61		41		122	

5. PLANT IN OPERATION.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Plant in operation,	13	76	23	43	15	45	51	49
Plant not in operation, ...	4	24	31	57	18	55	53	51
Total with data given, ...	17		54		33		104	
No data, ...	3		7		8		18	
Total, ...	20		61		41		122	

6. HOW DISCOVERED.

	Special Hazards.		Common Causes.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Employee, ...	14	70	25	42	16	43	55	47
Watchman, ...	1	5	12	20	5	13	18	16
Thermostat, ...	..	..	1	2	1	3	2	2
Sprinkler Alarm,	4	20	18	31	7	19	29	25
Outsider, ...	1	5	3	5	8	22	12	10
Total with data given, ...	20		59		37		116	
No data, ...	..		2		4		6	
Total, ...	20		61		41		122	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	Number of Fires.	Per Cent. of Whole.
Extinguished or practically extinguished fire,	82	75
Held fire in check,	24	22
Unsatisfactory,	3	3
Total,	109	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

732. February 4, 1900. St. Louis, Mo. The fire originated in the building adjoining north, communicating through one opening in basement protected by double metal-clad fire doors. This communication opened into a fire-proof boiler-room which was used jointly by the assured and the firm occupying the building in which the fire originated. The fire was also communicated to the premises through windows, there being a very strong wind from the north and blowing flame against these windows.

Both of these buildings were of plank and beam construction with elevator shafts and stairways open and a large well-hole through all floors. The fire when discovered in exposure was through all floors and burning fiercely and the risk was on fire before the arrival of the fire department which was very prompt. The action of the sprinklers could not be ascertained as the heat from the fire was so great that it was impossible to get near the building. The fire spread from Broadway, which is the same as fifth street, to third street and destroyed several buildings. In this case it was impossible for the sprinklers to prevent the destruction of the building with contents.

The total loss to all buildings with contents will amount to about $800,000.

Summary: Exposure fire.

4606. June 25, 1905. Nashville, Tenn. The fire started in a four-story brick building, occupied as a wholesale and retail millinery house, on Sunday noon. The six-story sprinklered department store was located across a forty-foot street. The heat was sufficient to break the windows of the sprinklered departmental store on the third, fourth and fifth floors simultaneously and before fire department could set its streams in that direction almost the entire building was on fire. The elevator in this building is in about the center and the shaft furnished the draught to communicate the fire to every part of the building.

The sprinkler equipment was Grinnell, supplied by one connection with street main, ordinary street pressure of about 40 pounds, and a 4500-gallon pressure tank. The building was of ordinary construction situated on the corner of two streets. See Sprinkler Fire No. 4606, Page 76, April, 1906, Bulletin.

Summary: Exposure fire.

5639. February 24, 1907. St. Louis, Mo. Manufacturers sprinklers on dry system under light water pressure from gravity tank failed to operate promptly and fire got beyond control of sprinklers. For further details see Sprinkler Fire No. 5639, Page 48, April, 1907, Bulletin.

Summary: Defective sprinklers and light water pressure.

Exposure fires	2
Defective sprinklers and light water pressure	1
Total,	3

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control is satisfactory.)

257. December 17, 1898. New York, N. Y. Fire occurred in rotunda or large central light well in which there was a Christmas tree with the usual Christmas decorations, about one o'clock in the morning, from some unknown cause. It was discovered by one of the night men who sent in alarm. Fire seems to have started between the first and second galleries and opened two sprinklers on the first floor, four on the second, ten on the third and one at the top of light well, seventeen in all. Sprinklers checked fire and fire department put on the finishing touches. Risk was equipped with Grinnell Glass Disc sprinklers supplied by five pressure tanks containing 15,000 gallons of water also six gravity tanks of about 50,000 gallons total capacity. This exceptionally good water supply undoubtedly had much to do with controlling this fire, the conditions under which fire occurred being about as bad as possible in a risk of this class.

Summary: Floor openings.

633. December 13, 1899. Philadelphia, Pa. Very heavy exposure fire across a fifty-foot street from large mercantile risk. Exposure fire broke most of the windows and obtained here and there a foothold on the woodwork but was kept out by the fire department aided by the sprinklers. Thirty sprinklers in all opened. Loss estimated about $20,000.

Summary: Exposure fire.

843. February 3, 1900. Youngstown, Ohio. Four-story brick furniture store. Fire occurred in adjoining building and owing to the fact that there was a low central portion, making exposed unprotected windows, the exposure fire was particularly severe. A number of inside sprinklers opened and with the help of the fire department the exposure fire was held in check. The water was shut off sprinklers and it was afterwards found that there was some fire in the attic which had not been extinguished. Owing to the fact that the fire department had shut off the sprinklers at the street the assured could not turn water on and there was considerable damage in the final extinguishing of the fire.

Summary: Exposure fire.

1273. March 7, 1900. Philadelphia, Pa. Fire in adjoining build-

ing. Heat from exposure fire opened fifty-three sprinklers on various floors causing heavy water damage.

Summary: Exposure fire.

1308. December 24, 1900. Minneapolis, Minn. Fire occurred near entrance with high fancy ceiling, caused by the crossing of electric light wires in an exhibit tower over a stairway. Two sprinklers opened and held the fire in check, but considerable loss was caused from smoke and water approximating $14,000.

Summary: Floor openings.

2732. February 7, 1904. Baltimore, Md. This risk very narrowly escaped destruction in the Baltimore conflagration. Automatic sprinklers in concealed space under roof and open sprinklers at windows saved the risk. Total loss something over $10,000.

Summary: Exposure fire.

3487. December 13, 1904. Minneapolis, Minn. Serious exposure fire in the nature of a small conflagration across an eighty-foot street. Risk had a mansard roof and owing to the large area it would not have been under department control if fire had gained any headway. Between 95 and 100 sprinklers opened, mostly in the upper stories, and held fire in check. But for the sprinklers risk would have undoubtedly been destroyed and fire become a full-fledged conflagration. Loss about $110,000. Details of this fire are given in Secretary's Report, No. 91.

Summary: Exposure fire.

4328. May 10, 1905. Utica, N. Y. Fire started in unsprinklered department store and spread to exposure adjoining. Shutters and open sprinklers helped keep fire out of risk and only five sprinklers opened. The tank caught fire and fell, breaking through roof and caused additional water damage. Loss about $35,000.

Summary: Exposure fire.

4920. June 3, 1906. Omaha, Neb. Fire occurred on Sunday and there was no watchman or alarm service. Water ran for some time until discovered by passer-by. Very heavy water damage. See Page 84, Sprinkler Fire No. 4920, October, 1906, Bulletin.

Summary: Lack of alarm service.

10. POINTS OF INTEREST FROM SPRINKLER FIRE REPORTS.

Concealed Spaces.

1571. Fire started at bottom of open elevator shaft, plastered and metal-clad ceiling, and got into concealed space where sprinklers could not extinguish it.

2654. Fire spread in back of lath and plaster ceiling where sprinklers could not reach it.

5891. Fire was inside sheathing in basement. Ceiling was joisted

with lath and plaster finish, also tinned under plaster. No sprinklers operated and fire was extinguished with chemical streams.

Gate Valves.

674. Fire department were unable to locate the proper gate valve to shut off water. They shut off the water-closet service, and sprinklers remote from the fire, but not until the electrician arrived was the proper valve closed.

Floor Openings.

4802. Fire occurred at bottom of elevator shaft. Shaft is equipped with automatic wood hatches which closed on all floors preventing what might otherwise have been a bad loss.

Obstruction to Distribution.

1172. Fire occurred in show window containing a display of white goods and spread rapidly to adjoining window, probably owing to some obstruction it was not immediately held in check. A number of heads opened in the main store which finally held the fire in check. Twenty-eight sprinklers in all opened.

730. Fire occurred in show window underneath a sort of step shelving where water from sprinklers could not reach it.

Sprinklers Shut Off to Prevent Freezing.

4265. Sprinklers in waste chute were kept shut off. Fire started here and spread into baling room before sprinklers were opened.

Prominently Successful Sprinkler Fires.

3912. Fire started in pile of wicker chairs and swings well wrapped in excelsior and paper. Two sprinklers opened and extinguished the fire.

5590. Severe exposure fire, being a conflagration of several buildings, held in check by inside sprinklers. Full description is given in April Bulletin, 1907, Sprinkler Fire No. 5590, Page 50.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of fires.	Per cent.	Held Fire in Check. No. of fires.	Per cent.	Unsatisfactory. No. of fires.	Total. No. of fires.	Per cent.	No. of Sprinklers Operating.	No. of fires.	Per cent. of whole.
1	47	57	6	26	0	53	48	1	53	48
2	17	21	5	22	0	22	20	2 or less	75	69
3	8	10	0	0	0	8	7	3 or less	83	77
4	5	6	1	4	0	6	6	4 or less	89	82
5	1	1	2	9	0	3	3	5 or less	92	85
6 to 9 inc.	2	2	1	4	0	3	3	Less than 10	95	88
10 to 24 inc.	2	2	2	9	0	4	4	Less than 25	99	92
25 to 49 inc.	0	0	4	17	0	4	4	Less than 50	103	95
50 and over	0	0	2	9	3	5	5	50 and over	5	
Total	82		23		3	108				

Average number of sprinklers opened not including unsatisfactory, 5.0.

12. ALARM SERVICE.

	Satisfactory.		Failure.		Total.
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	
Watchman alone	5	83	1	17	6
Sprinkler alarm alone	13	93	1	7	14
Thermostat alone	..	..	..	..	..

	Watchman.		Sprinkler Alarm.		Thermostat.		Total.
	Satisfactory.	Failure.	Satisfactory.	Failure.	Satisfactory.	Failure.	
Watchman and Sprinkler Alarm, ...	9	12*	20	1	..	..	21
Watchman and Thermostats, ...	..	..	..	..	..	..	..
Sprinkler Alarm and Thermostats, ...	..	..	3	..	3	..	3
Watchman, Sprinkler Alarm and Thermostats, ...	2	1*	2	1	1	2	3

*These include fires where sprinkler alarm or thermostats notified the watchman.

NOTE.—These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

Points of Interest From Fire Reports as Regards Alarm Service.

230. Fire was not discovered until employee arrived in the morning. There was no watchman or other alarm service. Sprinklers extinguished fire with moderate water loss.

1698. Thermostats and sprinkler alarm operated and started the transmitter but through some defect a continuous single signal was received at the central station so that the fire could not be located. The trouble was either in the transmitter or the circuit to central station.

13. SECONDARY WATER SUPPLIES.

664. Primary supply gravity tank, secondary supply steam fire pump. Fifteen sprinklers opened from exposure fire; heavy pressure maintained by the pump.

1571. Primary supply pressure tank, secondary gravity tank. Fire in concealed space opened up twenty-eight sprinklers pressure tank partly exhausted and 6,000 gallons used from gravity tank.

2654. Primary supply gravity tank, second supply steam fire pump.

Heavy pressure maintained by pump but this supply probably of little real service.

5639. Primary supply to sprinklers pressure tank also gravity tank and water-works. Defective sprinklers operated slowly and a large number opened overtaxing the supplies. Unsatisfactory fire.

From the above it would appear that in only two cases was the second supply of much, if any, service. In one case the steam-pump helped out the gravity tank and in the other case the gravity tank was of service in backing up the pressure tank.

14. EFFICIENCY OF WATER SUPPLIES.

Primary Water Supply.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Water works,	39	36	74	6.4	72	23	5	73	74	48	2.2	19.3
Gravity tank,	16	15	22	1.4	50	50	0	23	22	0	2.1	18.6
Pressure tank,	50	46	104	2.5	86	12	2	103	118	90	2.0	5.5
Automatic pump,	3	3	75	2.0	100	0	0	75	0	0	2.0	
Total.	108		80	5.0	76	21	3	84	68	62	2.1	15.5

15. EFFICIENCY OF WATER PRESSURES.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	3	3	11	4.3	66	33	0	11	11	0	4.0	5.0
15 to 24 lbs. inclusive,	8	7	19	18.0	38	62	0	18	20	0	2.0	27.6
25 to 49 lbs. inclusive,	6	6	34	2.4	50	33	17	31	34	40	2.0	3.0
50 lbs. and over,	91	84	90	4.0	81	16	2	91	92	73	2.1	13.8
Total,	108		80	5.0	76	21	3	84	68	62	2.1	15.5

16. EFFICIENCY OF WET OR DRY SYSTEM.

Wet or Dry System.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	95	88	78	4.1	76	22	2	81	66	65	2.1	11.2
Dry system,	13	12	96	11.6	77	15	7	102	85	55	1.9	60.5
Total,	108		80	5.0	76	21	3	84	68	62	2.1	15.5

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES. As Regards Amount of Loss.

Primary Water Supply.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Water works,	39	36	74	6.4	38	42	20	75	71	68	1.6	2.0	30.0
Gravity tank,	16	15	22	1.4	50	31	19	25	20	20	2.5	8.2	32.6
Pressure tank,	50	46	104	2.5	66	30	4	108	97	100	2.2	2.0	17.0
Automatic pump,	3	3	75	2.0	100	0	0	75	0	0	2.0		
Total,	108		80	5.0	55	33	12	87	75	62	2.1	3.1	29.5

18. EFFICIENCY OF WATER PRESSURES. As Regards Amount of Loss.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	3	3	11	4.3	66	33	0	11	11	0	4.0	5.0	
15 to 24 lbs, inclusive,	8	7	19	18.0	25	37	37	20	18	20	2.5	13.6	32.6
25 to 49 lbs. inclusive,	6	6	34	2.4	50	33	17	28	39	40	2.0	3.0	
50 lbs. and over,	91	84	90	4.0	57	33	10	95	85	78	2.0	1.9	28.1
Total,	108		80	5.0	55	33	12	87	75	62	2.1	3.1	29 5

19. EFFICIENCY OF WET OR DRY SYSTEM. As Regards Amount of Loss.

Wet or Dry System.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	95	88	78	4.1	56	33	11	85	70	63	2.2	3.2	19.3
Dry system,	13	12	96	11.6	46	39	15	102	101	115	1.7	2.0	120.0
Total,	108		80	5.0	55	33	12	87	75	62	2.1	3.1	29.5

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

General Fire Record.

FIRE-PROOF BUILDINGS FIRE RECORD.

F—1. New York, N. Y. June 8, 1907. A fire occurring on June 8 in a New York City fire-proof building deserves more than usual attention on account of the several unusual features involved, particularly the spread of fire from floor to floor by outside windows instead of by the usual stair or elevator openings.

The building erected in 1902 has an area of 3,300 square feet and is ten stories high with steel frame and floors of segmental arches of ordinary brick, laid flatwise on arched stamped metal tee pieces which were sprung between steel beams in a span of approximately six feet, this arch presumably overlaid with light cinder concrete, covered with single wood floor. The walls are of brick, faced on two street sides with white marble. Stairs and elevators fully enclosed in fairly good partitions, partly fire-proof. Ordinary light glass windows, unprotected on the two street sides and shuttered on rear alley. No private protection except standpipe and a few pails.

Occupancy: Numerous manufacturers and dealers in millinery, feathers, flowers, laces, etc., and on the second floor for the mounting and selling of hair ornaments which seem to have consisted chiefly of celluloid combs.

The fire occurred about 2.30 p. m. in second story, caused presumably by the careless throwing down of a lighted match or cigar. The spread of the flames was so rapid that the two occupants of the room had only time to get out safely without saving any property of any sort. This story was thoroughly burned out, and the flames communicated to story after story above to the seventh by means of the three side windows near the rear end of the building.

The alarm was not received promptly by the public department, owing to the fact that the person who attempted to pull the street box did not understand its operation and only succeeded in getting an alarm to the department, probably ten or fifteen minutes after the fire started, and then from a box several blocks away, so that when the firemen arrived they found a well-developed blaze and were unable to catch up with it below the seventh story.

The effect on the building was to ruin practically all of the plaster and woodwork on the second floor, and to a considerable extent on the third and fourth stories. Several windows and their frames were burned out on all floors from the second to the seventh, a little glass was broken by the hose streams in the eighth floor, and considerable of the marble facing in the vicinity of the windows mentioned was badly broken or spalled from the second to the seventh stories.

None of the floor beams or arches were injured, though the beam soffits were covered only by an inch of plaster, and there seems to have been no damage to important structural members of the building.

There was nothing unusual about the size or arrangement of windows to favor the spread of fire, they were about 3x6 feet each, in pairs, with a stone mullion between each pair separated horizontally by about four feet and vertically by about three feet of stone wall. However, there was more or less millinery and similar stock piled on the inside sills of these windows close to the glass, which accounts for the spread of fire. The elevator and stair shafts were fairly well enclosed and did not communicate fire from floor to floor; in fact, fire did not enter the shafts at all, though it would doubtless have entered had not the heat found a vent through windows at an early stage of the fire.

The fact is again emphasized, that to confine fires to the floors in which they originate, not only must there be effective protection at interior vertical openings, but equally effective window protection provided, so that the fire forced laterally out of the windows on one floor by the resistance of the ceiling, may not, by crawling up the outside walls, enter windows in floors above.

The unusual combination of a careless smoker in a stock of celluloid, a delayed alarm, and windows piled with inflammable goods is one that good construction, and even *fairly protected interior* vertical openings could not wholly withstand.

The loss on building was adjusted at 6.1%, about half of which was to mason and plaster work and half to interior finish and fixtures.

E. T. CAIRNS, *Chairman.*

S-5177. Manhattan, N. Y. July 24, 1906. Department Store. Floors of reinforced concrete. Thirteen sprinklers operated and controlled the fire. Water ran down to floors below through holes in the concrete floors through which leads to arc lamps pass.

This is a common defect in fire-proof buildings and many floors which would act as good fire or water stops are rendered inefficient because of holes which have been cut through same to accommodate pipes, conduit, etc. —Editor.

H-1499. · Beverly, Mass. December 17, 1907. Machine-Shop. Fire occurred in addition under process of construction. Reinforced concrete with wooden moulds and stagings. Stoves used for heating and drying out the concrete it being winter weather, fire undoubtedly caused by one of these stoves. Damage $1,500 loss to moulds and stagings, practically none to the building itself.

UNSATISFACTORY OR SERIOUS FIRES IN RISKS EQUIPPED WITH SPRINKLERS.

5181. Uxbridge, Mass. December 27, 1906. Worsted Mill. One sprinkler opened but water only trickled out of the head. Later on pipe was taken apart and pipe was found partly plugged up.

Summary: Sprinkler pipe clogged.

6054. Massachusetts. April 21, 1907. Cotton Mill. Cotton in yard. Fire communicated to joist constructed storehouse with plank and lumber roof.

The fire was discovered in 863 bales of cotton piled in the yard about six feet westerly from the westerly end of the cotton storehouse. Fortu-

nately there were a number of workmen on the plant, including the engineer in the power house. When the alarm was given the engineer immediately started the steam fire pump and for about an hour one rotary pump was run at half speed in connection with steam pump.

The roof of the storehouse together with the westerly end and half of the southerly side will have to be rebuilt.

About 175 bales were scorched and partially burned; the remaining portion, except possibly part of two bays in the easterly end were thoroughly wet. About 80% of the cotton was piled one bale high on end, with one bale flat on top, the remainder one bale high on end.

During the fire it was noticed that the water supply of the sprinklers on the southerly side of the storehouse was not sufficient, and it was thought possible that in cutting through the roof the sprinkler pipe might have been broken. On examination made after the fire it was found that the side pipe was undoubtedly obstructed and four heads at the end of the lines on the northerly side were filled with gravel. The obstructing of the sprinkler line on the southerly side is undoubtedly the reason why the roof is so badly burned over these sprinklers, and if all the sprinklers could have obtained water freely, the fire would not have extended more than two bays from the westerly end.

Summary: Sprinkler pipe clogged.

6056. Port Blakely, Washington. April 22, 1907. Saw Mill. The sprinkler system in east end was out of commission at time of fire owing to the fact that system was to be extended to cover the new addition recently erected. The dry pipe valve was being relocated and the sprinkler system in this part of the risk was entirely out of service. It appears that there was unnecessary delay in making these repairs otherwise they would have been completed before the fire. The fire started in the east end and was soon beyond control, the sprinklers in the rest of the plant being at such a disadvantage that they could not be expected to hold the fire in check.

Summary: Water shut off for repairs.

6182. Indianapolis, Ind. July 7, 1907. Wholesale Drug Risk. Adjoining building collapsed and at the same time the sprinklered risk adjoining also collapsed. It is said that there was no fire previous to the collapse but that fire started afterwards. Fire itself did very little damage and was controlled by the fire department. Sprinkler system was out of service by the collapse of the building.

Summary: Building collapsed.

6136. Marlboro, N. Y. July 28, 1907. Carpet Yarn Mill. Risk destroyed by fire. After fire the three inside gate valves were found closed so that the sprinkler system was not in service. Inspection report states that the management was slack and the care of fire appliances was poor and it appears that the system was not properly maintained.

Summary: Water shut off sprinklers.

6185. Mattapan, Mass. August 13, 1907. Dismantled Plant. Fire occurred in early afternoon while plant was closed down and being overhauled and remodeled. It appears that in taking down machinery one of the sprinkler supply pipes was injured or broken and the controlling post indicator in the yard was closed. Fire occurred and before gate could be opened it is probable that a large number of sprinklers were fused

which together with the broken pipe made the sprinklers of little or no value. The fire was controlled by means of hose streams with a damage estimated at $15,000. There were conflicting testimonies as to the water being shut off but the above appears to be the only logical explanation.

Summary: Water shut off due to break in pipe.

6080. Rochester, N. Y. August 29, 1907. Candy Factory. Fire started in basement of ordinary joist constructed building with brick walls, used mainly for storage, the floors above being occupied for candy manufacturing. Risk equipped throughout with Walworth sprinklers, wet system, supplied by water-works giving 55 pounds in basement and about 12 pounds in attic. Second supply a 5,000 gravity tank, three feet above top line. Fire probably smouldered in basement for some time and probably extended to ceiling before sprinklers operated, after which fire was confined between joist channels till it reached open elevator shaft when it soon reached the top floors. This was a seven-story and basement building and city pressure on top line was not more than 12 pounds, line with several sprinklers operating in basement, there was probably no water except from gravity tank available at this point. It is probable that the accumulated gases ignited and spread the fire rapidly over the upper floors, thus opening up large number of sprinklers and draining the tank quickly.

The causes of the failure were—First: open frame elevator shafts.

Second: Wide spacing (not staggered) and old standard piping.

Third: Alarm system out of order and watchman failed to make his round at accustomed time.

Fourth: Small tank not properly elevated.

Fifth: Height of building and relatively low city pressure.

Summary: Floor openings.

5819. Bay City, Mich. September 2, 1907. Soft Woodworker. Fire started in lumber dry kiln near fan room. Owing to obstruction to distribution from the lumber it appears that fire was not controlled by the sprinklers and it finally spread to the main mill. By this time a large number of sprinklers had opened overtaxing the water supply. Kiln was equipped with Grinnell glass disc sprinklers, dry system, and spaced about nine feet apart and there was an attic above, also sprinklered, 134 sprinklers in the kiln altogether. Water-works supply was rather weak pressure being from 35 to 38 pounds and although this pressure was supposed to be increased at time of fire it appears that there was not water enough for the steamers. There was a gravity tank and a steam pump additional supplies but by the time fire had spread to main mill it was practically beyond control of the sprinklers.

Summary: Obstruction to distribution. (Lumber dry kiln).

6205. Fall River, Mass. September 15, 1907. Cotton Mill. Fire occurred in picker house ell near fly-wheel apparently on the level with wheel. Stone walls, mill constructed floors. Risk equipped with Grinnell metal disc issues "B" and "D." Old pipe sizes, sprinklers 10 feet apart on 12 foot bays. System supplied by water-works 40 pounds pressure and steam-pumps.

Two days previous to the fire, risk was inspected and the binder pulley over fly-wheel was seen to be throwing oil. This was near the upper end of the fly-wheel, nearest the mill and just outside of the enclosure. The

inspector asked to have this condition remedied. Attention was promised on Sunday.

Therefore, on Sunday, September 15, 1907, some time after ten o'clock a. m., a machinist was working in the engine-room, making repairs to the oiling apparatus on this countershaft which operated the dynamo. After finishing the job he moved the ladder and left the room. About ten minutes later, he had occasion to pass through the mill near this point and saw a fire just below where he had been working. Cause unknown. He gave the alarm at about 10.50. Another workman claims to have seen the fire at its incipiency, and says that a few pails of water at that time would have extinguished it. The master mechanic was informed of the fire and passed through the basement of main mill from machine-shop and was almost overcome by smoke in the passage at this point. The main belt gave way and almost struck him. He sent in a public fire alarm about 10.58. Both these men state that the fire flashed immediately up through the belt boxes into the various floors of mill. There were no sprinklers inside of belt enclosures. When the superintendent arrived, a few minutes past eleven, smoke and flames so filled the mill that he could not enter.

The fire was very hot and the smoke unusually dense. Glass lamps near the stair tower were melted so that they hung like stalactites, and the windows were badly cracked and blackened. Paint is blistered everywhere. The floors are badly burned on the first, second, third and fourth stories, where the picker house ell joins the main building, one-half to two-thirds across the building and from four to eight bays in width. Also back about 50 feet in picker house ell. At no time did building No. 3 appear to be menaced. The value of solid mill floors without openings was shown by preventing the fire from reaching the upper floor and roof of mill.

In all, about 650 sprinklers operated. The following table shows the distribution and type of heads that operated. They were all Grinnell and largely the metal seat.

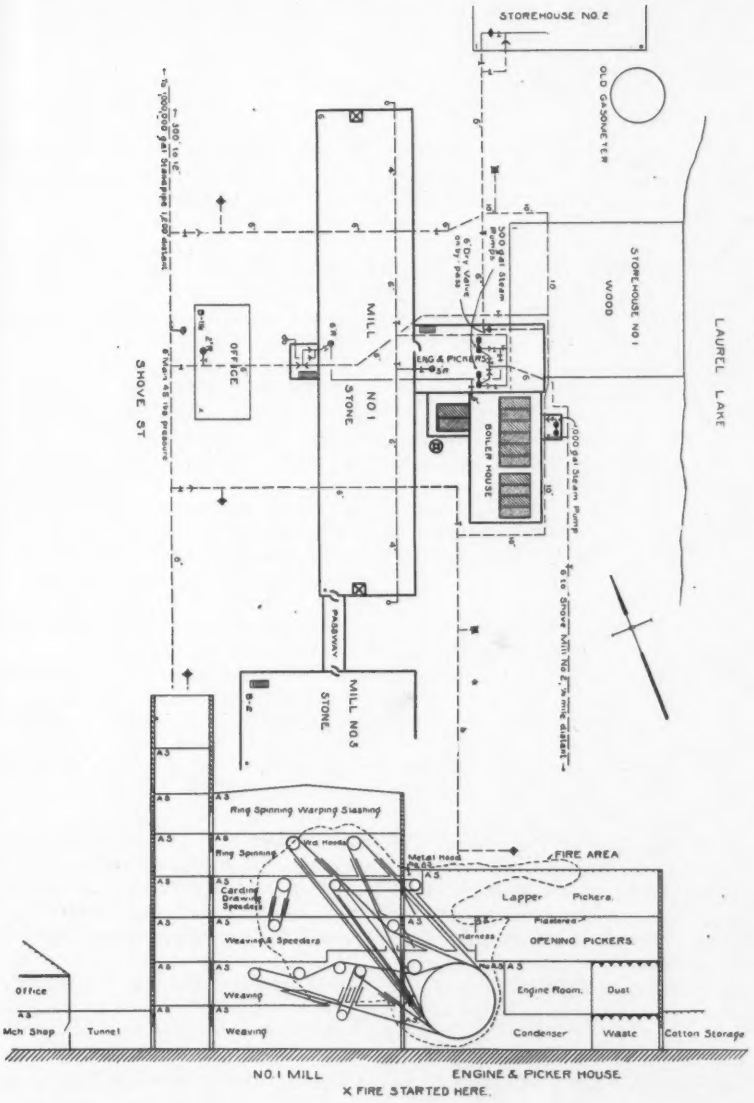
Mill. Basement five open, first floor 45 issue "B," second floor 62 issue "B," third floor 204 issue "D," fourth floor 210 issue "D," fifth floor 28 issue "D."

Picker House. Basement none open, first floor 31 glass disc, second floor 15 issue "B," third floor 45 issue "D."

All of the issue "D" sprinklers that apparently were sufficiently heated, operated. Of the 167 issue "B" sprinklers found affected by the fire, 122 were open and 47 had the solder melted but had not opened. That is, of the issue "B" heads that were subjected to sufficient heat, 30 per cent. failed.

The 1000 gallon and two 500 gallon pumps of assured were started and also the 1000 gallon pump at Mill No. 2, one-fourth mile away in Tiverton, R. I. The fire department responded with engines. There is a standpipe on the picker house which extends to the roof, and from this effective streams were obtained and directed to the fourth and fifth stories of mill. The value of standpipe and roof hydrant protection for making stream available on upper floors of high buildings was clearly demonstrated. There were at one time, 12 streams in operation.

The city pressure was weak. It is normally only 45 pounds. It is



Sprinkler Fire No. 6205.

probable that a large number of heads opened on the various floors during the first few minutes of fire, thus greatly reducing the pressure. Even when pumps were started the pressure was probably not over 40 to 50 pounds at hydrants, and some steamer streams were taken from yard hydrants. The sprinklers in the upper part of the building were not, therefore, able to discharge enough water to prevent excessive charring and burning of the woodwork. But the great value of pump protection, especially when the water pressure is low, was very obvious. If it were not for the ample pump capacity from the four available pumps, the supply for the large number of sprinklers and hydrants that were in use, would undoubtedly have proved utterly insufficient and a total loss might have occurred.

Prominent Facts Brought Out by the Fire. The need of substantial, non-combustible belt enclosures, tight at each floor, without openings to room, unless belt boxes can be dispensed with. The necessity of having sprinklers in every part of main belt enclosures and fly-wheel casings. The value of substantial hangers for sprinkler pipes.

The undesirability of allowing steam fire-engines to draw from yard hydrants supplied by pumps when street hydrants or ponds are available. The unreliability of Grinnell metal seat issue "B" sprinklers.

Improvements as a Result of the Fire. All metal seat Grinnell sprinklers of either issue have been replaced by the glass disc pattern. Pipes have had substantial hangers put on where necessary. Mill will have a standard electric light equipment installed.

The belts are all to be completely enclosed in an expanded metal and concrete casing, tight at floors and ceilings, with no openings into room, except for bearings, which will be capped. These casings will all have sprinklers inside. This work is to be done under the direction and according to the specifications of the Associated Factory Mutuals and is to be a radical treatment for this condition. The assured have given them carte blanc to make this job a model for excellence.

The reasons for fire getting beyond sprinklers' control were probably as follows:

First: Large unsprinklered belt boxes.

Second: Unreliable sprinklers. (Grinnell "B").

Summary: Floor openings.

6096. Sheboygan, Wis. September 23, 1907. Furniture Factory. Fire occurred on third floor of frame building, lath and plaster ceiling, under joist and spread to dip tank containing 200 gallons of benzine stain. Quick flash fire resulted which spread to other dip tanks, five in all. This made a very quick spreading hot fire which got into concealed space and 198 sprinklers in all opened. Fire was finally controlled with the aid of hose streams. Risk equipped with Grinnell glass disc sprinklers, dry system, modern spacing and arrangement, supplied by water-works at 80 pounds and gravity tank. Water supplies seem to have been adequate and lesson to be learned is that dip tanks should have proper overflow pipes and automatic covers.

Summary: Dip tank fire.

M-7-12-'07. St. Stephen, New Brunswick. Cotton Mill.

At 3.30 a. m. the watchman, while on his rounds, discovered fire in colored cotton bins located in the second story of the dye house building.

This building was equipped with automatic sprinklers, but for some reason unknown they did not extinguish the fire in the beginning. The public alarm was immediately given and three or four hose streams were brought into play which were fed by the town water. These streams lowered the pressure to such an extent that there was little or no water left for the sprinkler equipment. When the manager arrived, some twenty minutes after the alarm was given, he ordered all but one stream shut off and the small steam-pump in the boiler house started, which also gave one good fire stream. There was difficulty in starting the rotary pump, due to no one being on the premises who was capable of doing so. It was about thirty minutes before this pump was started. In all, six hose streams were used and one hundred and fifty-six sprinklers opened. The water from these extinguished the fire after about one and a half hours' duration. The efficiency of the sprinkler equipment was greatly interfered with by the pulling down of the pressure, due to the use of hose streams and by the fact that the check valve underneath the tank on the roof was found so corroded that it did not open. The fire extended through the blowing system into the dryers in the third story. There was considerable damage to the building and to the stock, which consisted of colored cotton. Loss, $6,847.74.

Summary: Insufficient water supply.

M-8-9-'07. New Durham, N. J. Rubber Works.

At 7.30 p. m. a fire occurred in the mixing room in No. 10 cement house, the cause of which is unknown. The process of mixing cement is carried on in this room and five 50-gallon churns are used. No heat is required in the process but a large quantity of naphtha is used. There were 250 gallons of compound in these churns and 377 gallons in cans. The building was closed at 6 p. m. No machinery was running and the current for the only electric light was turned off. At 7.30 p. m. one of the employees went to the building for a supply of cement. He set his lantern down near the door of the building and opened the same. The naphtha vapor with which the building was probably partially filled, flowing through the doorway, was ignited by the lantern. The entire room was immediately in flames, and the man himself was so badly burned that he was removed to the hospital. Eight sprinklers in the room opened, and with the assistance of seven hose streams, sand, and chemical extinguishers, the fire was extinguished. About five minutes after the fire started there was an explosion which blew out the greater part of the end wall and also somewhat damaged the roof of the building. Loss, $895.60.

Summary: Hazard too severe to control.

LARGE LOSS SPRINKLER FIRES.

Where Sprinkler Control is Satisfactory.

6201. Connecticut. January 7, 1907. Rubber Works. Fire occurred in first floor of storehouse sometime during the night or early in the morning. One sprinkler opened and extinguished the fire and no one knew about it until storehouse was opened in the morning. Floor was

covered with water and this leaked through into basement. Storehouse used for storage of reclaimed scrap rubber and chemicals.

Summary: No alarm service.

5867. New York, N. Y. March 9, 1907. Clothing Factory. Fire occurred under wood shelving on fourth floor in stock of clothing. Building of fire-proof construction. Twenty sprinklers opened and held fire in check but could not extinguish it owing to obstruction to distribution from shelves. Shelves were 6 feet, 3 inches wide and 29 feet long and there were three shelves two and one-half feet apart and two tiers of each. Fire occurred under lower tier of center shelf and jumped across narrow aisle to upper tier of shelves on either side. Four thousand gallon pressure tank drained and 3,000 gallons from gravity tank. Heavy water damage.

Summary: Obstruction to distribution.

5876. Wheeling, W. Va. March 15, 1907. Sheet-Metal Stamping. Exposure with unprotected windows. Thirty sprinklers opened and kept fire from entering risk. Street pressure failed and gravity tank was nearly exhausted by time fire was under control.

Summary: Exposure fire.

5963. Brooklyn, N. Y. February 5, 1907. Carpet Mill. Fire occurred in first story, mill construction, occupied for storage of carded jute in bales and finished stock. Jute was piled seven bales deep. Sprinklers held fire in check and hose streams had to be used to finally extinguish it. Forty-five sprinklers opened supplied by water-works forty pounds pressure and a good fire pump.

Summary: Fire in baled jute.

5990. Auburn, N. Y. September 4, 1907. Cordage Works. Fire occurred in frame warehouse of one-story light joist construction wood-trussed roof, used for storage of finished binder twine. Fire started in pile of binder twine and was discovered by employee. This building was equipped with Grinnell glass disc sprinklers, dry system, sprinklers nine to ten feet apart on open joists, not staggered, one line in each 12-foot bay. System supplied by automatic steam-pump, 35 pounds pressure and water-works. Twenty-nine heads opened and held fire in check but could not extinguish it.

Fire occurred in a frame stock house No. 2 in a pile of finished and baled harvester twine and from all outward appearances started at floor, working its way into center of pile where it smouldered out of reach of water, burning a hole entirely through floor. The appearance of floor both on top and below indicates that the fire worked down rather than up.

Assured claim that fire was caused by spontaneous combustion, but from the appearance of storeroom at present, and the general cleanliness at the time of a recent inspection, also from the fact that the plant was not in operation and only a few men were employed in shipping stock, it is highly probable that smoking was the cause of the fire, especially on account of the class of help employed. A cigar or cigarette butt thrown at the base of the pile would be liable to cause the loose ends and oily cordage dust to smoulder and work its way into the pile. The heat was sufficient to open 29 sprinklers in vicinity and keep fire from spreading outside of pile in which it originated, confining it to one bay 12 feet in width.

Cordage was piled 25 feet in height, closely packed and within two feet of nearest sprinklers.

Sprinklers operated promptly and were augmented by three streams from pump, two being taken directly from pump and one from yard hydrant. Nineteen streams were taken from city hydrants. Fire caused dense suffocating smoke and firemen broke open 18 skylights in nine bays to allow smoke to escape, which probably prevented other sprinklers from opening. Had the fire department kept out of risk, it is quite probable that sprinklers and private streams from pump would have taken care of fire with considerable less damage. As it was, a much larger proportion of the stock was wet down and more damage was done to building than was necessary. The baled balls of twine shed the water readily and it was only after pulling the piles down that the fire was finally drowned out.

Actual damage to building by fire was slight and $50 will probably cover it. The damage to stock by fire was light and $10,000 will probably cover it, a great many bales being slightly charred or scorched. The greatest damage is water damage which will cause rotting of stock. The appearance of the peak of the roof shows the necessity of sprinklers at this point, this place showing the greatest effect of fire. Loss estimated at $150,000.

Summary: Obstruction to distribution.

5993. Philadelphia, Pa. September 14, 1907. Cordage Works. Fire occurred in first floor of brick warehouse, plank and timber construction, occupied for storage of jute in bales also finished rope, twine and cotton cloth. Cause unknown in bale of jute. Building equipped with Neracher sprinklers 124 in room, 22 opened. Good spacing and arrangement, dry system, sprinklers supplied by automatic pump 40 pounds pressure and a 16,000 gallon gravity tank. Sprinklers held fire in check and prevented it from spreading but could not extinguish it owing to the obstruction from the bales of jute, of which there were about 800 piled in one corner to within a few feet of the ceiling. Hose streams were used to good advantage and bales were pulled out and fire extinguished little by little. The water swelled the bales of jute pushing over three of the wooden columns tearing them loose at the top. Loss estimated at $40,000 to $50,000.

Summary: Obstruction to distribution.

M-5-14-'07. Sandy Hill, N. Y. Wall Paper Mill.

At 8.15 a. m. an employee, working in the basement of section No. 3 of the mill, heard water escaping from the sprinkler system. Upon investigation fire was found in bundled, finished wall paper stored here. Ten sprinklers opened, and without doubt they alone would have extinguished the fire, but because of the dense smoke in the room twelve hose streams were brought into play through end and side windows, causing heavy damage to the contents of the room, which consisted of about 240,000 rolls of finished wall paper and about 150 tons of white paper. The cause of the fire is unknown. It may have been due either to a match on the floor or to incendiarism. Loss, $7,800.

Summary: Susceptible stock.

M-5-21-'07. Lowell, Mass. Cotton Mill and Print Works.

At 10.30 a fire occurred on the third floor of the printing building. On the walls of the steaming and aging room are fans which blow air down into the sub-basement, from which it passes through steam-pipes

and up through gratings to hot-hoxes, the air then being delivered by another fan out-of-doors. The fire was probably caused by friction in one of the fans and was discovered as it came from one of the hot-boxes into the folding room. It followed a wooden flue up into the steaming and aging room, damaging the flue and also the woodwork of the room. The tin cylinders on two of the hot machines were also damaged. Eighteen sprinklers opened and with the assistance of four large and eight small hose streams the fire was extinguished in about an hour. A few belts, and the blankets and backing on the twelve printing machines, and about 500,000 yards of cloth were damaged by water. Loss estimated at from $5,000 to $7,000.

Summary: Concealed spaces.

M-8-6-'07. Ludlow, Mass. Jute and Flax Mill.

At 11.30 p. m. the watchman at No. 10 mill discovered smoke coming out of the ventilators of storehouse "S." He immediately gave the alarm which was responded to by the employees. As they entered the building which was full of smoke, flame was seen along the side of the pile of bales near the east wall of the building. Fire, however, had entered the opening between the bales and worked its way nearly all over the pile so that as the bales were torn down nearly every bale was more or less scorched. This honeycombing of the pile made it very difficult to extinguish the fire. The building was equipped with automatic sprinklers which are on the dry-pipe system in the winter. At the time the fire occurred water stood directly on the sprinklers, having been turned on in the spring. In all, twenty-five automatic sprinklers opened and five hose streams were used and the fire was practically extinguished after about one hour's duration. The building itself was but slightly damaged, but the loss on the contents will be large. The building was occupied for the storage of American hemp which is subject to rapid heating when wet; hence, every effort was made to remove the stock at once and dry it out. The weather was particularly favorable for this purpose, but in spite of everything that could be done the loss will be in the neighborhood of 65% to 70% of the sound value, due to rapid deterioration by the water and by the heat generated in the stock. Loss, $30,000 to $35,000.

Summary: Obstruction to distribution.

M-8-28-'07. Lewiston, Maine. Cotton Mill.

At 2 p. m. a fire occurred in the second story of the north section of storehouse No. 5. This section was occupied for the storage of waste, and as one of the employees was rolling a bag over, fire flashed up and quickly spread throughout the room. The building was equipped with automatic sprinklers and also with perforated pipes. The automatic sprinklers were on the dry-pipe system controlled by a four-inch Grinnell valve which promptly opened. The supply to the perforated pipes was also turned on, but it was thought that most of the automatic sprinklers were open before the water was let into the system. From the thoroughly wet condition of the contents and the slight fire damage to the building, there seems to have been a good supply of water from both systems. Ten streams were also brought into play and the fire extinguished after about three hours' duration, having spread from the second story in which it originated, through numerous small holes in the floor to the attic above. The damage to the building is but slight, but the contents of the same,

consisting mostly of card waste, were badly damaged. Loss estimated at from $15,000 to $20,000.

Summary: Quick spreading fire, cotton waste.

OTHER SPRINKLER FIRES OF ESPECIAL INTEREST.

5909. South Brooklyn, N. Y. March 28, 1907. Jute Warehouse. One-story brick, high studded, plank roof. Jute in bales piled nine and ten bales high. Five sprinklers on dry system opened and practically extinguished the fire. Loss slight.

5926. Camden, N. J. April 16, 1907. Oil Cloth Factory. Fire occurred in coating and drying room. This room equipped with a modern sprinkler system with excellent water supplies. There was a line of sprinklers directly above each rack and a line over each aisle. Furthermore there were aisle sprinklers or "rack sprinklers" placed on vertical lines in each aisle, two heads on a line vertically and lines spaced approximately seven and nine feet. These rack sprinklers were set horizontally and have metal hoods to prevent being wet down by sprinklers above. Seventeen of the ceiling heads operated and held the fire in check. None of the "rack sprinklers" opened as the heat was not intense at this point, also the fact that these sprinklers were 212° made them less sensitive. Hose service was used to advantage. Loss about $2,000.

5927. Allegheny, Pa. April 17, 1907. Exposure. Severe exposure from adjoining risk there being no window protection. About nine heads opened on each floor on each side forming a water curtain and keeping the fire from entering the building. Window frames were burned away and inside woodwork charred. Risk would have undoubtedly been destroyed but for the sprinklers.

6119. New York, N. Y. May 22, 1907. Metal Workers. Fire started on sixth floor under forge and apparently worked through crack in flooring to the fifth floor which was vacant. Fire spread along ceiling between the joists without opening the sprinklers and burned up through the floor again to the sixth floor. The sprinklers were not staggered under the open joists and if they had been they probably would have stopped fire from spreading.

6186. Leominster, Mass. July 9, 1907. Celluloid Comb Factory. Fire started in pile of combs in process located on a wooden box attached to one of the comb-cutting and bending machines. These machines are heated enough to render the stock pliable. It is supposed that the celluloid ignited due to overheating. Fourteen sprinklers opened and practically extinguished the fire, loss being about $100.

6183. Newark, N. J. July 10, 1907. Celluloid Factory. The building in which this fire occurred is one story and basement in height, with a low blind attic, brick walls, joisted roof, smooth wood sheathed ceiling and joisted floor. There is no inside finish except on the ceiling. The attic was accessible by means of a small trap-door held open by a fusible link. The building was cut off from the main plant on one side by a blank wall, and on the other side by a similar wall with one opening covered by a sliding tin-clad door, non-automatic. The other sides faced on an area and on street respectively.

The building was occupied in the basement for paint grinding. The

first floor contained the cracking machines and four hand pumps for solvents which were in tanks in another building, but were filled through openings from this room.

The cracking machine consisted of a brass roller approximately two feet long, set with brass teeth about one-half inch apart, these teeth being set staggered with reference to the axis of the roll. These teeth meshed in a steel plate which was fixed, the roller bearing the teeth being free to revolve.

The machine was entirely open and discharged into an open copper chute, which emptied either into a batch box lined with metal and placed upon a small truck, or into a galvanized-iron barrel, as might be desired.

The four pumps referred to are ordinary measuring pumps operated by hand-power, one being for wood alcohol, two for grain alcohol denatured with wood alcohol and camphor and one for castor oil. Beside each pump is a filling opening to tank covered by a brass wire strainer and a cloth.

The operations carried on in this room are as follows:

Celluloid in the form of sheets about 18x24 by approximately ¼ inch thick are brought in in a covered galvanized-iron barrel and fed by hand into the cracker which breaks the sheets up into small fragments about ½ inch square and ¼ inch thick. These fragments are then moistened in the room with the proper proportion of solvents drawn from the pumps and allowed to stand until thoroughly permeated going thence to the calendaring machines to be reduced to a homogeneous mass.

The sheets as brought into the cracking room consist of nitro-cellulose, camphor and coloring matter which has been mixed together in a finely divided condition, pressed between linen cloths under very heavy pressure, and when brought into the room are perfectly dry and resemble sheets of white pasteboard.

It is not usual to have any great quantity of the materials in the room, all that is kept there being that which is to be put through the process.

The room was under the protection of nine Grinnell glass button sprinklers spaced about 7x8 feet fed from a 2-inch riser in the corner, and one sprinkler directly over the delivery of the machine. The primary supply was from pressure tanks giving from 75 to 80 pounds at the sprinklers. The sprinklers were on a wet system.

At about 9.15 on the morning of the tenth, an employee was feeding sheets of celluloid into the machine, while two others were emptying a barrel of alcohol into the strainer connected with one of the tanks, when suddenly fire burst out at the machine. The heat opened all of the sprinklers in the room. The vapors of the nearly empty alcohol barrel exploded blowing out head of same. The employee at the machine was fatally burned and the other two seriously injured.

There was absolutely no other explosion than the slight one in the alcohol barrel, which only blew out the head, the barrel itself being rolled out into the yard blazing. The celluloid in the machine and in the receiving barrel was consumed, but some which was in a covered batch box was not damaged at all and was afterwards worked up. The windows in the room were cracked by the heat, the ceiling scorched and the machine somewhat damaged. The entire property loss was probably not $50 and no claim was made upon the insurance companies.

The sprinklers operated for about ten minutes and several streams were brought to bear from factory hose and one from a fire-engine. Four engines and two trucks responded to the alarm which was given from the private box at the works

The sprinklers held the fire in check beyond question, and would undoubtedly have extinguished it without the aid of the hose streams. The level in the three pressure tanks was dropped about four inches, showing that 1260 gallons of water were used. The fusible link in the trap-door to the attic operated instantly and no sprinklers in the attic were opened.

The cause of this fire is unknown. It may have been from static electricity, friction, or a piece of metal in the stock. After a careful examination and consideration of the circumstances, it would seem that static electricity and friction are very remote possibilities, and that while every care is taken at this plant to eliminate foreign matter from the stock, the most probable theory is that in some manner, not easily understood, a piece of metal must have gone through these rolls causing a spark and inflaming the mass of very dry celluloid.

The result of this fire demonstrates several things.

First: That burning celluloid in small or moderate quantities is entirely under sprinkler control.

Second: That an explosion of celluloid is highly improbable, there having been absolutely no evidence of any explosion whatever save that of the alcohol barrel, the breaking of the windows being evidently due to heat and hose nozzles. There were three quart bottles of some liquid standing on a shelf which were not thrown down or damaged in any way.

Third: That it is desirable to have these machines in cut-off rooms, as is done at this plant, and to keep the quantity of material in same down to a minimum.

Fourth: It would seem to be desirable that when it is necessary to fill one of the tanks of solvents, the machine should be stopped.

This fire was handled in an ideal manner by the sprinklers, and the factory force, there having been absolutely no failure of any fire appliance to operate in an entirely satisfactory manner.

5991. Newburyport, Mass. August 12, 1907. Celluloid Comb Factory. Fire occurred on second floor occupied for cutting, grinding and making celluloid combs. Fire probably caused by spontaneous ignition of hot celluloid blanks piled on shelf. Fifteen sprinklers opened and entirely extinguished the fire. This is an example of a celluloid fire properly controlled by sprinklers.

M-6-11-'07. Bristol, Pa. Enameled Leather Works.

At 9.50 a. m. a fire occurred in the varnish mixing house, under the following circumstances:

A one hundred and twenty gallon tin tank was being filled with turpentine for thinning purposes. Across the top of the tank were laid two sticks and on these a fine brass wire strainer, ten or twelve inches in diameter, and in this a piece of muslin. Two men were employed bringing fourteen-gallon cans of turpentine and emptying the same into the tank through the strainer. This had been done twice, but in emptying the third can fire flashed up, apparently from the interior of the tank, burning the face and hands of one of the men. The dense smoke drove the men out of the building, and a hose line was immediately brought into the doorway

from the nearest hydrant. Others were added as fast as possible, two at each door, four through the roof, and one in Building No. 18, to which the fire had passed through a small pipe hole in the floor. A thousand-gallon Underwriter pump was immediately started and ran at high speed for about an hour. The force of the streams upset the smaller cans, containing mixed varnish, and lifted the covers from larger ones so that the contents of the room are a total loss. The mixing room was equipped with a sprinkler system and all the sprinklers in the room opened, and the ceiling of the room is not charred except for about ten feet in the end in which the fire started. In consideration of the large amount of inflammable material contained in the room and in tanks near by, the fire was exceedingly well handled. The cause of the fire is unknown, but very likely was due to static charge of electricity gathered by the men walking over the coating of the floor; this charge igniting the turpentine or possibly other vapors. The fire lasted about one and one-half hours. The damage was confined wholly to the varnishes stored in the room. Loss, $3,574.05.

M-8-23-'07. Fairville, New Brunswick. Sulphite Pulp Mill.

At 4 p. m. a fire was discovered in the chip conveyor tower through which chips are conveyed to the bin in the upper part of the digester building. The fire was first discovered about eight or ten feet above the roof of the engine room. The Underwriter fire pump was immediately started and ran at a very high rate of speed for over an hour. The automatic sprinklers, with which the tower was equipped, controlled the fire for a time, but it finally spread into the top of the chip bins. Seven streams were also brought into play but considerable water was wasted by playing on the outside of the tower. As the uselessness of the outside streams became apparent they were gradually shut off, thus giving a better water supply for the sprinklers and preventing fire from gaining more headway in the roof. A hose stream was finally brought into the chip bin and played into the upper part of the tower, extinguishing the fire. The tower, together with a few feet of the roof of the digester building and the conveyor machinery, were practically destroyed by fire. Loss $3,038.24.

POINTS OF INTEREST, SPRINKLER REPORTS.

Alarm Service.

5903. National open flat type thermostat failed to operate, probably owing to lack of sensitiveness. Auxiliary box of same system also failed due to some trouble at the box.

5907. Dry valve sprinkler alarm out of service at time of fire on account of water on system.

5921. Lever check connected to central station and outside electric bells. Alarm failed to operate owing to lack of proper sensitiveness.

5932. Watchman discovered fire and immediately sent in alarm from the Gamewell auxiliary box. Department responded promptly and aided the sprinklers in controlling the fire.

Concealed Space.

5885. Fire occurred at intake of large blower fan which blows the air through the condensing coils and distributes it to the different floors. Sprinklers in the fan enclosure prevented fire from being blown through

the air ducts but fire spread into the shavings used for filling the partition of air duct where water could not reach it.

5891. Fire occurred inside of sheathing in basement. Ceiling was joist with lath and plaster finish tinned over plaster.

5975. Sprinklers were of little service because fire was mostly in a tight metal unsprinklered dry box where water could not reach it.

Cut Off.

5894. Fire spread through small pipe hole in fire wall back of small fixture used for storage of office files.

CAUSES OF FIRES.

Special Hazard Causes.

H-1454. **Foundry.** Spark from the iron when pouring ignited frame partition close by. There should be no combustible material near where the pouring is done.

H-1460. **Electrical Appliances.** Fire occurred in frame asbestos and metal-lined japan drying closet heated by coal-stove with metal pipe extending through attic, used for drying japanned switchboards, etc. Fire probably caused by defective stovepipe. An unsafe and undesirable arrangement.

H-1461. **Metal Worker.** Fire occurred at tempering furnace heated by crude oil. Plant had just closed down and workman was dumping furnace into a small pit containing about two inches of water when explosion occurred and plant was partially destroyed.

H-1468. **Brewery.** Fire occurred in small frame addition containing pitching kettles. This was fired by wood and had a metal flue. Employee after lighting fire went away for a short time and building was ignited. A hazardous process and should be carried on only in a detached or fire-proof building.

H-1474. **Pottery.** Fire occurred in barrel containing pottery ready for shipment. These were in close proximity to an overheated kiln.

H-1492. **Metal Worker.** Fire occurred where stack of brass furnace passes through roof. The brass melting and refining furnace used being like a small Bessemer converter using oil for fuel, the combustion of oil taking place inside of the furnace and flames are emitted from the top. There was a heavy sheet-iron hood about 18 inches above the mouth of the furnace and a round iron stack 18 inches in diameter extended from hood through the roof and about 15 feet above the roof. Woodwork of roof cut away for a space of about seven to nine inches from the stack and a sloping sheet-iron collar fitted around the stack down to roof boards. The tarred paper of roof being flashed up on to this sloping collar. Pieces of sheet-metal were placed on the underside of roof boards, fitting tightly around the stack. It will be noticed that this did not allow a good circulation of air and the excessive heat undoubtedly ignited the roof boards. The fire could not be reached with pails and there were no chemical extinguishers or small hose available, this allowed fire to spread.

H-1497. **Patent Leather Factory.** Linseed oil is boiled in an open kettle by a wood and coke fire, heated to about 580° F. The kettle is then rolled out under an iron shelter and paddled to assist cooling. It is then emptied into another kettle and when the temperature has lowered to about 250° it is reduced with naphtha and turpentine which are added slowly and stirred. While this was being done an explosion occurred, fire igniting the wood trim of the building and setting fire to a pot of varnish near by. It is probable that the oil was not properly cooled before adding the naphtha.

H-1507. **Oil Warehouse.** Gasolene fumes igniting from heating boiler caused explosion of oil tank. Heating boilers or open lights should not be allowed in buildings used for storage of gasolene or similar materials.

H-1519. **Linseed Oil Mill.** Fire occurred on third floor occupied by filter presses and was undoubtedly caused by spontaneous combustion of filter cloths.

H-1521. **Refining Metals.** Fire occurred at melting furnace due to crack in masonry, allowing heat to ignite woodwork. Furnace was built against wood wall of building. A poor arrangement.

H-1538. **Distillery.** Fire caused by friction in wooden elevator boot.

H-1556. **Shoe Factory.** Fire occurred in cement house, employee stepped on match while drawing rubber cement from barrel.

H-1595. **Laundry.** Fire occurred in building used for cleaning curtains, draperies, etc., in benzine. Draperies were placed in benzine in a revolving laundry machine and after washing were laid on copper-covered tables to drain, benzine being collected in a galvanized pail under the table. It is supposed that pail struck a spark in some way which ignited the benzine. A hazardous process.

H-1620. **Foundry.** Sparks caused by the dump from cupola probably fell among a pile of wooden flasks 12 feet from cupola. Flasks should be stored a safe distance away. Watchman discovered fire. It is stated that he made his regular rounds at 5.15 and 6.15 p. m. when he discovered that the records were not being registered on the clock. Watchman called up superintendent who told him to wind the clock and continue his rounds. He started in again at 7.00 o'clock and when in the engine-room saw fire in foundry. Except for statement of watchman there is no evidence that he visited the foundry at all as clock was not registering.

H-1624. **Coffee Roasting.** Heated coffee in coffee cooler set fire to woodwork. Cooler should be constructed of metal or other non-combustible material.

H-1635. **Wood Box Factory.** Shavings dropped out of boiler grate to cement floor and fire spread to shaving vault, door to same having been left raised a few inches.

H-1636. **Wood Alcohol Plant.** Fan draws smoke from charcoal kilns to condenser and blows the gas through underground pipe to boiler-house across the street where same is burned under boilers. Back draft burned gas in pipe which caused explosion igniting fan house. Chemist says accident was due to gas being too rich.

H-1648. **Foundry.** Cupola foundation settled throwing stock against woodwork igniting same.

H-1664. **Foundry.** Fire started near cupola which was poorly arranged with a wood charging floor. There have been three fires at this same plant. Cupola should be safely arranged with non-combustible charging floor.

H-1677. **Metal Workers.** Fire occurred in lacquering room at a sheet-iron oven about six feet square, heated by gas-jet underneath. It is supposed that fire originated from vapor of some lacquer which was being heated in a pot of hot water near oven, the vapor being ignited by the gas-jet under the oven. The fire was prevented from entering the other building by a fire door.

H-1696. **Woodworker.** Fire started in basement in a pile of shavings. It spread quickly to the second and third stories through the frame shaving chute and also spread to first story through unprotected openings. All shavings and similar materials should be conveyed by a suitable blower system to a properly constructed vault. Floor openings should be properly protected.

H-1697. **Car Works.** Fire started in second story of brick building occupied as a brass foundry with melting furnace with a hood cover and metal stack projecting through the roof. The wooden roof was supposed to be protected at the point where stack passes through but the intense heat set the inner side of the roof on fire. There was no fire apparatus on the floor and by the time the yard hose could be brought to bear the fire had assumed too much headway to be checked. The floor under melting furnace was of cement which prevented the fire from communicating to the first floor. The wooden roof is to be made non-combustible and fire appliances will be placed on each floor.

H-1703. **Wholesale Druggist.** Man went to basement to draw from a barrel of "tar oil," explosion followed. Barrel said to have contained only a small quantity of oil and it is probable that inflammable vapors in the barrel were ignited. Damage slight as basement had arched ceiling.

H-1714. **Sheet-Metal Works.** Fire occurred on fifth floor of a reinforced concrete building, starting near two frame metal-lined japanning ovens. Fire was caused by some japan spilled on floor near japan ovens, workman tried to light the all-iron gas-heated oven near, a spark from the match fell into the spilled japan starting a small fire. The man tried to beat the fire out with a broom which promptly caught fire and fanned the flame. He then became confused and ran from the room promptly followed by the other twelve men on the same floor, so that the many sand and water-pails on the floor were not used to extinguish the fire. The neighboring fire department was called and said to have arrived late, when the two wooden drying ovens were practically consumed.

H-1715. **Producer Gas Plant.** "Low" process (water-gas) and plant has been in operation for the past thirty-five years. Explosion resulted from a leak in one of the pipes, the gas being ignited by the fire in the boiler furnace in an adjoining room from the purifying section. The force of the explosion wrecked part of the gas-house. No fire.

H-1716. **Tin Can Factory.** Gasolene gas used for lighting and

manufacturing processes. The storage tank was above the grade of the gas manufacturing building and this latter building in turn was above the grade of factory. Drain from gas-machine floor empties into underground brick trench which runs on down grade to side of shop and thence into sewer-pipe, which latter runs to a long open topped water-closet vault. It is believed that gasolene in some way ran into this trench, due to leak at machine, following down to the water-closet vault where it vaporized and exploded. After main plant burned the gas-machine house burned, and with it part of the contents of the generators which held approximately 4,000 gallons of gasolene and kerosene. Generator finally burst.

Valve in pipe from storage tank was found closed after the fire but valve controlling gas supply to risk was open at time of fire and after the explosion was not accessible. Total loss.

Recommendations: Gasolene tanks should be so set that top of tank is below bottom of generators and also below grade of plant.

H-1939. **Fur Hat Factory.** Fire occurred in the evening and caused an insurance loss of about $9,000. This fire showed conclusively that there is an inherent hazard in the alcohol recovery process, which obtains in this class of risk that should be more clearly recognized and stringently regulated.

This risk was equipped with the alcohol recovery apparatus of the Solvent Recovery Co., and had the latest type of recovery oven and condenser. Wood alcohol was being used. There were no lights in room. The watchman was making his nine o'clock round. As is often done at night, he stopped to open the door of the recovery oven. He set down his lantern (an ordinary kerosene oil type) opposite the oven door and not far from it. When he opened the door an explosion occurred which aroused the neighborhood. The watchman was severely burned and cannot coherently describe what took place. He affirms that he was not smoking nor did he upset his lantern in any way. From information available it does not appear that any appreciable damage was done by the explosion more than the breaking of windows and the destruction of the oven.

The watchman may have opened the oven door sooner than he should. That he should not have opened the oven in the presence of an open light is certainly a fact. Whatever usual or unusual conditions prevailed that night it is obvious that there was formed a critical mixture of wood alcohol vapor and air which exploded in the presence of an open flame, resulting in an explosion and serious fire.

This shows very forcibly that there is ever a potential hazard present owing to accidents, unforeseen conditions and the ignorance of men. Had this recovery process been located in a detached building the loss would undoubtedly have been very small.

There is nothing in the process of using rubber cement in the shoe shops that offers any hazard yet the amount that may be kept in the building at one time is carefully regulated because the potential hazard from the causes enumerated above are recognized. In a standard shoe shop viscolising is done in a detached building. In a cotton mill the picker room is cut off or detached. It may be argued that the liability of the hazard under discussion is more remote than those just mentioned. But on the other hand the possibility of large loss of life and excessive

fire damage is much greater. Even this very recovery process under discussion, Mr. Milton F. Jones, in a very able report, shows by investigation and experiment, that it does not possess a severe hazard and that "a certain amount of prejudice exists against this apparatus which it appears hardly to deserve." Yet he freely admits that "the potential hazard of an explosion is always present."

It seems, therefore, wise that we should use our influence in having this potential hazard removed by requiring that the recovery process be located in a detached building or cut-off section.

S-5813. **Shoe Factory.** "Fake," a substance containing turpentine used for shoe polish, was being heated over a kerosene oil stove when it took fire. This is the second fire from this cause and this material will hereafter be heated by steam.

S-5917. **Manufacture of Labels.** Fire occurred at dry box used for drying of varnished labels. Static electricity probably ignited the benzine vapors from the varnish.

S-5924. **Woolen Mill.** Fire occurred at stock dryer in dye house caused by friction at fan underneath. There were three fans underneath the apron and apron had become worn allowing stock to pass through. Fans should be located outside of dryer in an accessible place so that they can be properly cared for.

S-5930. **Manufacture Shoe Dressings.** The wax and other compounds are melted over gas-stoves, the kettle of melted compound is then brought out into the main room and poured into steam-jacketed kettles and turpentine added. One of these kettles ignited from some unknown cause.

S-5943. **Celluloid Factory.** Fire caused by foreign substance in stock that was passing through breaker being struck by teeth of breaker and causing spark. Four sprinklers opened and extinguished the fire.

S-6004. **Cotton Mill.** Fire occurred at cloth finishing machine. Probably started at fan in discharge pipe from friction.

S-6201. **Rubber Works.** Fire occurred in stock of reclaimed rubber scrap placed in bags. The scrap ignited spontaneously.

Common Causes.

H-1491. **Sugar Mill.** Fire occurred in boiler-room due to breaking of fuel oil pipe at base of boiler. The pump being in operation oil was forced against boiler and ignited cutting off approach to oil pumps. By the time oil supply was turned off at tank fire had communicated to main building and was beyond control.

Break probably due to poor connection or possible mechanical injury. Oil pumps to be located at a safe distance from boilers.

H-1550. **Brewery.** Fire started in concealed space at sides of old ice house, this space being filled with shavings and sawdust. These old buildings with sawdust filled walls should be done away with.

H-1565. **Harness and Collar Factory.** Electrician was repairing wires in basement with gasolene soldering pot which ignited a large stock of sweat pads. Fire spread rapidly and was soon beyond control.

H-1582. **Car House.** Two tanks containing "Pintsck" gas used

for lighting cars were in the building and employee first noticed flames coming from crack in one of the tanks. Almost immediately the other tank exploded which caused the remaining tank to explode. It is not known how the gas became ignited.

H-1629. **Tenant Manufacturing.** Fire occurred in one of the several wood barrels containing rubbish left standing in hallway near elevator.

H-1662. **Machine-Shop.** Exhaust from gas producer engine runs through a wall and down to a wood barrel partly filled with broken brick, etc., used as a muffler. There is a water-jet in the exhaust pipe to keep the brick wet. It is claimed that the jet was used regularly but barrel caught fire. The regular cast-iron muffler should have been used.

H-1667. **Cotton Waste Mill.** Fire supposed to have been caused by sparks from brick stack which lodged on cotton waste in dry room. Stack passes up through dry room and there was a small open joint in the brick work through which it is supposed the spark came.

H-1692. **Woodworker.** Fire on shingle roof, caused by sparks from iron stack. A number of fires have happened at this plant from same cause. Shingle roofs are to be replaced by composition. There should be an effective spark arrester on stack. The assured tried an arrester at base of stack but it checked the draft so that its use was discontinued.

H-1936. **Grist Mill.** Fire occurred in bin of tailings on top floor of brick, joist constructed mill, probably due to spontaneous combustion of tailings in bulk. Temperature high due to location under roof.

S-5875. **Blacksmith Shop.** Hot ashes placed in defective can ignited floor below.

S-5923. **Tenant Manufacture.** Wooden pulley became loosened on shaft and friction heated wood bushing until same ignited. Pulley fell to the floor and fired sawdust from buffing wheels.

POINTS OF INTEREST, SPECIAL HAZARD REPORTS.

Alarm Service.

H-1487. Fire discovered by night watchman who promptly pulled private alarm box calling the city department.

H-1634. Fire occurred about midnight and was discovered by an outsider, there was no watchman. By the time the fire department arrived the fire was beyond control.

H-1697. Stationary clock was destroyed by the fire and no evidence was left as to whether the watchman properly performed his duties.

H-1706. Watchman failed to discover fire in large dry kiln. Outsider saw smoke from street and turned in alarm. Watchman made rounds every two hours which is not sufficiently frequent to be reliable.

Chemical Extinguishers.

H-1699. Fire occurred in the huller on the third floor and was extinguished by chemical extinguishers and private hose.

Concealed Space.

H-1693. Fire started in three-foot space between the first floor and ground. Cause unknown.

Fire Department.

H-1665. Six steamers responded to fire but owing to the poor

quality of coal used it was almost impossible to maintain any satisfactory pressure on hose lines, not over 35 pounds being available at early stages of the fire which is slightly in excess of the hydrant pressure. It was about one half hour before streams could be gotten to reach above the second story windows and by that time fire was beyond control. Fire department is volunteer and seems to be poorly managed and maintained.

Fire Doors.

H-1655. Fire was confined to finishing and storage rooms by the fire walls and fire doors.

Floor Openings.

H-1520. Fire spread rapidly to upper floors through well-holes and stairs and burned through roof. The center of the building collapsed.

H-1680. Large well-hole, stairway and hoist enabled fire to spread quickly from lower to upper floors.

H-1685. The large open belt-hole and the open stairs allowed the fire to easily spread to the second floor. If these openings had been well shut off, fire would probably have been confined to first floor.

H-1698. Fire spread rapidly through the first floor and by the stairway to the upper floors. Stairway not properly enclosed.

H-1705. Fire spread quickly to upper floors through pine enclosed elevator shaft.

Hose and Standpipes.

H-1659. With inside standpipe and hose attached for immediate use, loss would have been nominal.

H-1676. City fire department pressure very weak on account of two hydrants having been turned on inside of the building which could not be shut off after fire started.

Outside Protection.

H-1598. There were no hydrants near enough for department to use properly. If there had been, fire would probably have been controlled in its early stages.

Pumps.

H-1457 Private fire pumps could not be used as there was no steam in the boilers at the time. At least 40 pounds steam pressure should be maintained at all times.

H-1474. Fire pump driven by gas-engine and as engine had to be shut off pump was put out of commission.

H-1716. Unable to use private steam-pump on account of fire being near boiler-room where pump was located.

MISCELLANEOUS FIRE RECORD.

H-1470. Fremont, Ohio. October 16, 1906. Car House. One and two-story brick building divided into two sections. Roof of two-inch plank; division walls 16 inches plastered to 20 inches, parapeted four feet with two openings protected by double tin-clad doors on each side of wall. Building used for repair shop and car house. Fire was discovered by watchman about 4 a. m. and fire department telephoned. They laid four lines of hose from two hydrants. Fire started in car house in the northwest end of repair shop section being caused by insufficient water in a Baker Hot Water Car Heater. Pipes became overheated setting fire

to woodwork of car. Three cars were totally destroyed and one partially. Roof was burned for a space of 100 feet and steel trusses fell carrying part of the outside wall with it. With the aid of the fire department fire was confined to the repair section.

H-1500. Framingham, Mass. December 17, 1906. Car Barn. Frame car house, open joist construction; gable, shingle roof. Fire discovered by foreman in front of building it having gained considerable headway. Trolley wire supports gave way so that cars could not be moved. Fire was soon beyond control and loss practically total.

H-1540. St. Louis, Mo. January 15, 1907. Electric Light Plant. Two-story brick building with wooden roof. Fire originated on roof for receiving the wires being caused by a cross outside of building between one of the power circuits and a high tension circuit due to a sleet storm. This short circuit set fire to the ceiling and fire spread rapidly. Fire alarm wires were out of service and alarm was sent in by telephone. The building also contained gas blower pumps taking gas from the gasometer and blowing into city gas mains. The cylinder head of one of these pumps blew off and the flow of gas made the fire more severe.

S-5868. Fall River, Mass. March 10, 1907. Theatre. In this theatre as in every theatre, there is a concealed space under the parquet and gallery circles. It is not customary to sprinkler these spaces, but at this risk these concealed spaces are properly sprinkled. From the hall leading up to floor at rear of gallery there is a small stairway, and space under this stairway is a part of the concealed space of gallery circle. Apparently the fire started under the aforesaid stairway and the heat opened four sprinklers in the concealed space. Dry valve opened properly and electric bell on dry valve rang and was found ringing by stage manager when he arrived, which was nearly one hour after watchman discovered there was a fire. Watchman must have been very much bewildered or he did not know where to shut the water off, although it is claimed that he did, however much time was lost in telephoning stage manager, etc., before the water was shut off. Fire department was called but did very little as the sprinklers did the work.

S-5896. Fall River, Mass. March 25, 1907. Steam Laundry. Fire in frame unsprinkled building twenty-five feet distant kept from entering by the inside sprinklers. No window protection.

ELECTRICAL FIRES.

H-1488. December 10, 1906. Fibre Box Factory. Fire caused by blowing out of open-link fuse near stack of strawboard.

H-1561. January 10, 1907. Machine-Shop. Fire started at or near the wooden switchboard. The current supplied to this board was from the street railway service at 500 volts. The exact cause of fire is unknown but fire was probably caused by a ground or short circuit. Switchboard should be of non-combustible material and the street railway service should never be used for lighting or power inside buildings.

S-5814. May 21, 1907. Theatre. Fire occurred in fire-proof resistance coil box in basement. This box is about five feet square made of brick with tin-clad door in front with small hole in top through which the

cable passes. Insulation ignited causing considerable smoke but no damage outside of box. A box of this kind should be vented outside.

M-6-3-'07. Paper Mill. When one of the cutters in the finishing room was started, a short circuit occurred in the electric wires which lead to the motor by which the machine is driven. The insulation was burned off of the wires and the woodwork was ignited. Three sprinklers opened and the fire was extinguished. Damage slight; no claim.

Notes and Tables.

STEAMER "PLYMOUTH."

New England Navigation Company.

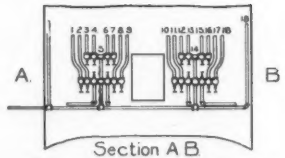
The steamer "Plymouth" was practically destroyed by fire about eighteen months ago. The steel hull and portions of the engines were saved. These were used in the building of the present vessel. She is practically a new boat, having been in commission about two months. She is a freight and passenger boat designed for service on Long Island Sound, and is allowed to carry fifteen hundred passengers. She is 376 feet long and of 3770 gross tons.

Except for its steel hull and steel bulkheads, of which there are five, the boat is largely constructed of wood, there being very little metal in the structure above the main deck.

In building the boat, the matter of fire protection was given careful study. Above the main deck, an attempt has been made to divide the boat into three fire sections by wooden partitions one and one-half inches thick, covered on both sides with sheet iron. The doorways through these partitions are protected by wooden doors, metal covered and sliding. There are numerous holes through these partitions for pipes and wires, but they should serve as a fairly good fire barrier. The vessel has the usual equipment of fire hose, connected with the pumping system of the vessel, fire extinguishers, axes, and a watchman and watch clock system with an Eco Magneto time detector. In addition to these the vessel is equipped with a complete system of mercurial thermostats, which very thoroughly cover the whole vessel, giving an alarm on annunciators in the engine-room.

The most unique feature of this vessel, however, is the system of automatic sprinklers, which covers the whole vessel with the exception of the engine-room and fire-room. The system was installed early in the present year by the General Fire Extinguisher Company, and consists of 1135 Grinnell sprinkler heads. We understand that there are but two other vessels equipped with sprinklers, and that the system in the "Plymouth" is much more complete than either of the other two.

The heads are all pendent and the spacing rather close, in most cases being eight feet or less in both directions. The system goes very thoroughly over the whole vessel, including all the staterooms, main saloons, freight decks and holds. The engine-room and fire-rooms are not sprinkled, although the light shafts over these portions have sprinklers under the skylights. The pipe sizing is the latest standard. The interferences to distribution are very slight. The system has for its primary supply a Blake trade pump, with capacity of 1000 gallons per minute. It takes suction from salt water, through an eight-inch pipe, extending directly through the hull of the vessel, under about six-foot head. It discharges through one six-inch pipe into two headers, from which twenty four-inch leads supply the various portions of the vessel. There is a valve in each one of these which is kept normally shut. The pump is equipped with a regulator and water pressure is maintained at 80 lbs. The pump takes steam



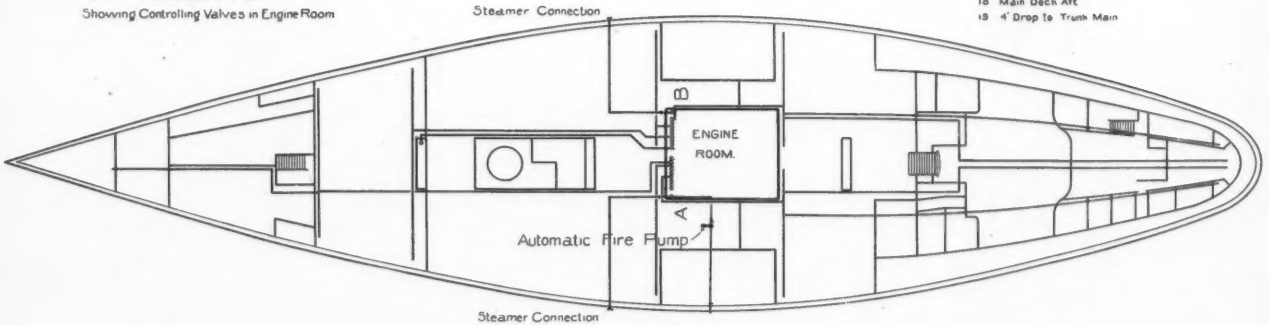
Showing Controlling Valves in Engine Room

Key

1 Gallery Deck Aft
2 Saloon Deck Mid Ship
3 Gallery Deck Forw rd.
4 Main Deck Aft
5 6" Supply From Trunk Main
6 Saloon Deck Aft
7 Main Deck Mid Ship
8 Main Deck Forward
9 Dome Deck.

10 Saloon Deck Forward.
11 Gallery Deck Forward.
12 Saloon Deck Mid Ship
13 Main Deck Forward.
14 6" Supply From Trunk Main
15 Gallery Deck Aft
16 Main Deck Mid Ship
17 Saloon Deck Aft
18 Main Deck Aft.

19 4" Drop to Trunk Main



Steamer Plymouth.

Plan Showing Sprinkler Mains & Connections.

Starkweather & Shepley Inc
Inspection Dept
Prov. R. I.

from the auxiliary steam main, and there are several valves between the pump and the boilers. It exhausts into a main which delivers either to the atmosphere or to the condensers. Ample steam supply is maintained at all times, at pressures ranging from 100 to 170 lbs.

There is also a four-inch Siamese connection on each side of the boat which delivers into the trunk main between the pump and the supply headers, so that fire boats or steam fire-engines can pump water into the sprinkler system if so desired. There is no convenient way of testing the delivery of the fire-pump.

The method of operation is as follows: Should a fire occur, it would operate a thermostat which would give an alarm on an annunciator in the engine-room, showing under which section of the sprinkler system the fire occurred. The engineer on duty would immediately open the corresponding valve, which would put the section of the sprinkler system involved under full pump pressure. The sprinkler heads would then fuse and operate in the ordinary manner.

Although the pump and the heads themselves are automatic, it will be seen that the system as a whole depends on human intervention before it gets into operation, but as there are always men on duty in the room where the annunciators and sprinkler valves are located, when the vessel is in commission, it would seem probable that there would be a fairly prompt response in case of an alarm on the thermostatic system.

The officers of the vessel report that there has been absolutely no trouble with the sprinkler system since the vessel was put into commission. There have been three or four cases of sprinklers being bent on the freight decks, but no leak has been reported.

The following were the only places noted as not being properly covered:

Stairway from main deck to kitchen, one head.

At ventilator fan in forward glory hole, four heads, or cut down partition which interferes with distribution.

Under stairway at starboard side of dining saloon, one head.

Various small coat closets and lockers.

Outside of paddle-box on main deck.

Space around rudder head in the extreme stern.

(The last three items are not important in this case.)

As a whole the system appears to be very well designed, and exceptionally well installed, and if the man on duty acts promptly, there is no reason why this system should not control any ordinary fire on this vessel. Furthermore it appears that at least a large portion of this equipment could be maintained strictly automatic if desired and that such sprinkler systems could be made to compare very favorably with what is considered good practice on land.

C. B. MACKINNEY,
Starkweather & Shepley, Providence, R. I.

Note.—It would seem that this protection could be materially improved by installing a pressure tank of say 6,000 gallons capacity which would give an automatic heavy pressure supply to the sprinklers. The feasibility of installing sprinklers throughout steamers has been well illustrated in the above instance and the protection should be of great value.—Editor.

DENATURED ALCOHOL IN HAT FACTORIES.

Denatured alcohol is being used by many of the most progressive hat manufacturers of Danbury. Some manufacturers claim that it is not satisfactory and will not properly cut the shellac, but the fact that it is being used successfully seems to indicate that it will become quite generally used.

The improved conditions in the shops using denatured alcohol are at once noticed, both in the health of the men and in the very apparent freedom from the obnoxious and poisonous fumes of wood alcohol, and there is apparently much less vapor in the air. The Solvents Recovery Company find that they are getting a 10% better yield of alcohol from the recovery ovens where denatured alcohol is used, and this is an alcohol of 97% strength, as against an alcohol of 94% strength recovered where wood alcohol is used. This seems to bear out the fact that there is apparently less vapor in the air around the ovens where denatured alcohol is used, i. e. less alcohol is lost when the less volatile alcohol is used. There is, therefore, a distinct advantage with a decrease of hazard with the use of denatured alcohol.

J. ALBERT ROBINSON, *Inspector,*
The Underwriters' Bureau of New England.

SOLVENTINE.

This is a reddish brown liquid containing benzine or one of the lighter petroleum products dissolving some drying oil, possibly linseed. It is handled by the Hildreth Varnish Co., 90 West Street, New York City. It is sold in one gallon cans at 90 cents a gallon; five gallon cans at 85 cents per gallon and in barrels at 75 cents per gallon. It is being used in some of the whip factories of Westfield, Mass., as a varnish and several fires have resulted which are thought to have been due to this liquid.

Tests on the liquid show it to be very hazardous as it easily flashes at ordinary temperatures as does benzine and burns leaving an oily residue.

Further tests seem to show that it is also liable to spontaneous heating under favorable conditions though not as much so as pure linseed oil. Under our spontaneous combustion test cotton waste containing the liquid reached a temperature of 250°F. in three hours, showing evidence of some internal heating. Clean waste receiving the same amount of heat reached 180°. At 390° waste would take fire.

Because of its low flash and fire points it is extremely dangerous to use beside introducing the danger of spontaneous combustion.

W. P. TENNEY, *Inspector.*
The Underwriters' Bureau of New England.

COLLAPSE OF REINFORCED CONCRETE.

Philadelphia, July 11, 1907. A new reinforced concrete building was being erected by a sub-contractor who used a system of reinforcing concrete which is said to be after his own ideas. The reinforcing consists of six to seven round iron rods of about ¾ inch diameter, set in each girder,

four of these being bent into the form of a truss; rods are smooth and evidently do not take as good a hold on the concrete as twisted rods. There are about four of these rods in the columns.

Building was three stories and basement, first floor being about 14 feet high, second floor 12 feet high and third floor 15 to 20 feet high, having quite a high gable. Columns first floor appear to be about 14 inches, second floor about 12 inches, and third floor about 10 inches, although these dimensions may be two inches small in each case.

Columns were set 18 to 20 feet centers, with concrete girders about 12x16 inches between, and two intermediate beams forming about six foot bays between. Floors were four to five inches concrete laid in a coarse wire mesh, about three inch mesh, this apparently being the only reinforcing in the floors. There were brackets at corner of columns and girders in first and second floor, but not at roof.

This is about the section of building north and south on 15th Street. The two bays at north side and the length of building, five or six bays, east and west, fell.

Concrete mixture used is said to have been one of cement, two of sand and four of gravel. Mixtures appear to be even and concrete fairly good, although it was noticeable that the laborers had no trouble to break up the fallen beams with sledges, and considerable dust seemed to rise from the concrete under blows of the hammers.

The top floor is very high for such size columns, and it is said laborers removed the wooden columns supporting the centers or forms holding up concrete, and the girders and columns simply buckled and let the whole roof down on the third floor, and it went on down to the basement. The men are said to have been told to remove every other upright or prop under the forms and they took them *all out* instead, thus causing the accident.

These two north bays had been in place about a week on upper floors, while balance of building was older and cement better set.

Apparently the reinforcing rods do not tie into or rest over very far on the tops of columns, and it appears that the construction is a little weak compared to some other systems.

In looking at risk from sidewalk it was very interesting. The brackets at ceiling of second floor have all been sheared or broken off when the girders went; on first floor the brackets held, one being broken off but still held in place by the rods; some of the rods are hanging in air, these have actually been pulled out of the girders, the girders broken to pieces, probably by the impact of roof falling on them.

The whole thing has evidently been due to gross carelessness but the construction may have been somewhat at fault also.

Cheap labor, part colored, was used on the work, and two lives were lost and several men severely injured.

One girder had been pulled out by the roots and had the rods sticking out of broken end. Girder was cracked in several places and cracked along the length where rods were located, which was about three inches from the bottom face of girder.

ALBERT E. BRUEN, *Inspector,*
The Underwriters' Bureau of the Middle and Southern States.

DENATURING BONDED WAREHOUSE.

Mr. A. H. Nuckolls, Chemical Engineer of the Underwriters' Laboratories, and Mr. J. V. Parker have made the following requirements for a standard plant.

Dumping Tanks or Vats. Tanks or vats into which wood alcohol, benzine or other similar hazardous denaturants are dumped or emptied, to be located outside of building.

Storage Tanks. Tanks for storage of wood alcohol, benzine and other similar hazardous denaturants, to be of metal. All openings in top of tanks to have tight fitting covers, same to be closed at all times. Tanks to be provided with automatic vent pipes arranged to allow passage of air out or in as tanks are filled or emptied.

Measuring Tanks. Tanks for measuring the denaturants to be constructed in same manner as storage tanks.

Mixing Tanks. Tanks for mixing denaturants with grain alcohol to be of metal, (excepting tops, which may be of wood).

Piping. Galvanized iron pipe to be used for all underground piping, all connections to be perfectly tight, with well-fitted joints. Piping to be so arranged that wood alcohol, benzine and other similar hazardous denaturants must be pumped from one tank to another without exposure to the air, except that piping from the measuring tanks to the mixing tanks may convey the denaturants by gravity, if not exposed to the air.

Pump. Pump should be operated by steam produced in separate building without openings communicating with the denaturing bonded warehouse. If by electric motor, gas or gasolene engine, the motor and all switches and fuses, or engine should be located in room cut off by tongue and groove partition without openings communicating with the mixing room or denaturing material room. The motor or engine-room to have good outside ventilation.

Lighting. To be by incandescent electric, in vapor-proof globes with keyless sockets. Switches and fuses located outside of room.

Ventilation. Room used for the storage of denaturants to have outside ventilation. Ventilators should be placed in the walls, not over one foot from the floor, and also in the ceiling or walls at the top.

TEST OF DISCHARGE OF AUTOMATIC SPRINKLERS.

The attached sheet of curves gives the results of some tests on the relative discharge of various types of sprinklers at low pressures.

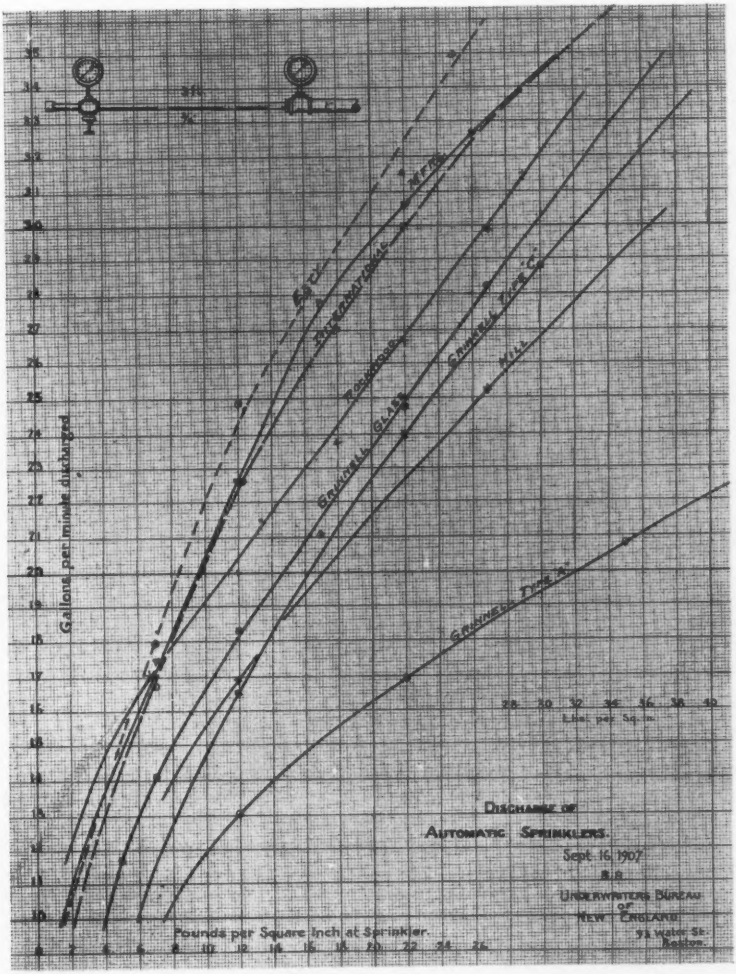
The arrangement of the piping, sprinkler and gauge was as shown in the sketch. Tests were made with city water under a pressure of about 40 pounds. Pressure was regulated by a gate valve on a 1¼ inch pipe about eight feet back of the sprinkler. When the desired pressure had been obtained and was found to remain constant the discharging sprinkler was swung over a metal barrel mounted on platform scales. When the required time had expired (from twenty seconds to one minute), the piping was swung back again. The time was taken with a stop watch which was started or stopped at the moment when the streams passed the edge of the barrel. The water was then weighed. Tests which showed any great variation in the gauge pressure were not used.

The curves are not accurate much below ten pounds owing to the small scale of the gauge. A mercury or water column would be necessary for this finer work. It is thought that the curves as a whole are fairly accurate as repeated tests gave practically identical results. The pressure observed varies somewhat with the manner of connecting the gauge. It was found that when the gauge was connected to the end of the pipe (where the air-chamber is shown on sketch), the readings were from one to three pounds more than when above the sprinkler. The latter position was used as it gives the pressure in the direction of discharge and is more commonly in practice. Probably differences of 5% can be obtained by varying the bushings and other connections to the gauge.

The curves for the Esty and Manufacturers sprinklers will not represent all sprinklers of these makes as the design or dimensions of the nozzle of these sprinklers has been changed slightly at times. The older sprinklers (Grinnell types A and C and the Hill), were added for comparison.

These curves are interesting as showing the relative discharge of the different sprinklers under similar conditions but should not be interpreted as giving the absolute quantity delivered for pressures observed otherwise than from the method here used.

The Underwriters' Bureau of New England


Gallons per minute discharged
Pounds per Square Inch at Sprinkler.
Lbs. per Sq. in.
Grinnell Type C
Grinnell Glass
Standard Glass
Standard Brass
Globe
Discharge of
Automatic Sprinklers.
Sept. 16, 1907
Underwriters Bureau
of
New England
93 Water St.
Boston.